

Cerambycidae of Northern Asia

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CERAMBYCIDAE OF NORTHERN ASIA

VOLUME 1

Prioninae, Disteniinae,
Lepturinae, Aseminae

*[Usachi Severnoi Azii (Prioninae,
Disteniinae, Lepturinae, Aseminae)]*

A.I. CHEREPANOV



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This monograph describes the morphology, geographic distribution, and biology of cerambycid beetles (Coleoptera: Cerambycidae) of four subfamilies (Prioninae, Disteniinae, Lepturinae, and Aseminae), comprising 124 species. Keys to taxa based on different developmental stages are presented here for the first time, host relationships examined, and the life cycle and ecology of each species assessed. This information forms the theoretical basis for resolving various practical problems.

Entomologists, ecologists, zoologists of wider specializations, and workers engaged in plant protection will benefit from this monograph. The book can also serve as a field guide for biology students of universities, agricultural and forestry institutes, and specialized technical schools.

Editor-in-Chief
N.A. VIOLOVICH
Doctor of Biological Sciences

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FOREWORD

Northern Asia covers a vast region from the Urals to the Pacific Ocean coast, and from northern Kazakhstan, Altai, the Sayans, northern Mongolia, and Amur to the Arctic Ocean coast. The species composition of cerambycids (Cerambycidae) in this territory, especially of adult insects, has not been studied well. The preimaginal stages and the life cycle of most of the species have remained unknown even though cerambycids are of vital economic importance, with some causing severe damage to forests.

In view of the foregoing, I conducted long-term investigations on the species composition and biology of cerambycids in different parts of northern Asia: Trans-Baikal—1939 to 1941; Tuva—1947 to 1949, 1970, and 1976; eastern Ural region—1953 and 1954; Kulunda—1950 to 1952; Altai—1959, 1960, 1966, and 1975; Salair—1968 and 1969; Ussuri-Primor'e region—1971 to 1973; Kuril' Islands (Kunashir)—1974; Sakhalin—1971; region of Ob' near Novosibirsk—1953 to 1977; forest-tundra near Salekhard—1954; and the southern Urals—1978. Round-the-year studies were conducted from 1967. In addition to the field work, many laboratory studies were conducted. These comprised over 10,000 experiments in which tens of thousands of larvae, pupae, and adult insects were raised. Two to three generations of many species were raised in the laboratory.

Such studies made it possible to identify the preimaginal stages quickly, to trace the life cycle of a species, to determine the characteristic features of individual developmental stages under various ecological conditions, to establish specific food relationships, and so forth. The resultant data forms the basis of this monograph, which has been divided into three volumes. The first volume covers the subfamilies Prioninae, Disteniinae, Lepturinae, and Aseminae; the second volume deals with the subfamily Cerambycinae; and the third volume the subfamily Lamiinae.

Volume I covers 124 species; ecological and biological characteristics are presented for 99 of them. This information is of vital importance in basing broad theoretical principles and in resolving practical problems of pest infestation in forests. Moreover, a general key to the taxa of the family Cerambycidae, based on developmental stages, is presented here for the first time. The validity of individual taxa has been re-examined, based on the data of comparative morphological and biological studies. Likewise the status of some genera (*Evodinus*, *Brachyta*) and species [*Nivellia sanguinosa* (Gyllh.), *Pidonia signifera* (Bat.), *P. alticollis* (Kr.), *Necydalis morio* Kr.,

N. ebenina Bat.] has been reviewed; some species described earlier have been reduced to synonyms (*Pidonia amurensis* Pic, *P. tristicula* Kr., *Necydalis ussuriensis* Plav., *N. eoa* Plav.), and a series of species and genera new for USSR fauna have been described. The classification adopted in this work has been supported by several researchers in recent years. It corresponds best with the natural history of the family Cerambycidae and fully conforms to the rules of the International Code of Zoological Nomenclature.

It gives me great pleasure to mention that N.E. Cherepanova participated in all the experimental investigations—both in the laboratory and under field conditions. As my main associate, Cherepanova meticulously planned the experiments, made the basic collections, and compiled the diary notes.

Students of the Novosibirsk Agricultural Institute and other academic institutes undertook entomological field work in the summer months and collected considerable material. Among them, special mention should be made of A.A. Mendrulya, F.M. Korytkova, A.A. Belozerova, and V.D. Barbarosha.

I am very grateful to artist A.Z. Ermolenko who sketched all the illustrations and participated in field collections, and to all those persons who cooperated in this work.

All illustrations are original except for those taken from my previous publications (see the Bibliography).

SYSTEMATIC LIST OF SPECIES

Family CERAMBYCIDAE

I. Subfamily Prioninae

1. Tribe Callipogonini

1. Genus *Callipogon* Serv.

1. *C. relictus* Sem. 49

2. Tribe Prionini

1. Genus *Prionus* F.

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3. Tribe Tragosomini

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II. Subfamily Disteniinae

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III. Subfamily Lepturinae

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6. <i>A. sachalinensis</i> Tsher.	227
7. <i>A. minuta</i> (Gehl.)	230
8. <i>A. anthracina</i> (Mannh.)	234
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INTRODUCTION

GEOGRAPHIC AND BIOTOPIC DISTRIBUTION

- 10 Studies on the species composition and geographic and biotopic distribution of long-horned beetles (Cerambycidae) of northern Asia were initiated by K.G. Lakshman, P.S. Pallas, K.F. Ledebur, A.G. Shrenk, V.I. Mochul'skii, F. Gebler, and other naturalists during the eighteenth and nineteenth centuries. The collections of these researchers during the course of their expeditions served as primary material in the publication of lists of species of cerambycids in different regions.

Research on long-horned beetles has been more intensive since the 1930's and a large number of papers have appeared in the Far East. Among the most important of these publications are those by Samoilov (1936), Kurentsov (1950), Shablinskii (1956, 1958), Krivolutskaya (1961, 1962, 1965, 1966, 1973), Ivliev (1966), Ivliev and Kononov (1963, 1966), and Plavil'shchikov (1954). Among the publications for eastern Siberia, mention should be made of these: Florov (1938), Tal'man (1940), and A.I. Cherepanov (1946, 1952a). For western Siberia these are significant: Kiseleva (1926), Tal'man and Yatsenkovskii (1938), A.I. Cherepanov (1952a-b, 1956), Prozorov (1958), Krivolutskaya (1965), and A.I. Cherepanov and N.E. Cherepanova (1971-1978). Work on the beetles of Kazakhstan includes a monograph by Kostin (1973). The monographs by Plavil'shchikov (1932, 1936, 1940, 1958) on Cerambycidae of the USSR, including northern Asia, are of great importance. Publications by some researchers abroad are likewise important: Kojima (1959, 1960), Kojima and Okabe (1960), Hayashi (1968-1976), Kojima and Hayashi (1969), Gressitt (1951), and Namkhaidorzh (1972). The works of Linsley (1959, 1961-1964) and Linsley and Chemsak (1972, 1976) on North American fauna have led to a more accurate understanding of the extensive Cerambycidae fauna of northern Asia and North America. A bibliography of the major publications on the Cerambycidae of northern Asia is given at the end of this book.

The long-horned beetle fauna (Cerambycidae) of each region differs in species composition, origin, and biotopological distribution. These differences are primarily due to plant associations. Most of the species are ecologically associated with wood and shrub vegetation and only a few with herbaceous plants (*Brachyta*, *Dorcadion*, *Eodorcadion*, *Phytoecia*, *Agapanthia*, and several others).

Tundra Zone

According to Pavlov (1948), the southern boundary of the tundra traverses Salekhard, Khantaika River, estuary of Khatanga River, Nizhnekolymsk, upper sections of Anadyr' River, and Korf Bay in Kamchatka. The Komandor and other northern islands fall within this zone.

- 11 Typical plant associations in the tundra comprise shrubs with willows (*Salix glauca*, *S. pulchra*, etc.) and dwarf birches (*Betula nana*, *B. exilis*, etc.) serving as a backdrop. Among long-horned beetles, *Saperda populnea* L. is found on willows in the environs of Khantaika River.

In western and eastern tundra sparse forests of larch (*Larix*), spruce (*Picea*), birch (*Betula*), alder (*Alnus*), and poplar (*Populus*) are common along river banks in drained soil. In such vegetation the following beetles were found on coniferous species:

- | | |
|---|---|
| 1. <i>Acmaeops pratensis</i> (Laich.) | 9. <i>M. urussovi</i> Fisch. |
| 2. <i>A. septentrionis</i> (Thoms.) | 10. <i>M. impluviatus</i> Motsch. |
| 3. <i>A. smaragdula</i> (F.) | 11. <i>Pogonocherus fasciculatus</i> |
| 4. <i>Judolia sexmaculata</i> (L.) | Deg. |
| 5. <i>Asemum striatum</i> (L.) | 12. <i>Acanthocinus carinulatus</i> |
| 6. <i>Tetropium gracilicorne</i> Reitt. | GebI. |
| 7. <i>Callidium coriaceum</i> Payk. | 13. <i>Anoplodera sequensi</i> (Reitt.) |
| 8. <i>Monochamus sutor</i> L. | |

The most abundant species were *Monochamus sutor* L., *Acmaeops pratensis* (Laich.), and *A. septentrionis* (Thoms.); *Monochamus urussovi* Fisch. was found only here and there. Deciduous species in the tundra hosted *Nivellia sanguinosa* (Gyllh.), *Oedecnema dubia* (F.), and *Leptura arcuata* Panz. *Brachyta variabilis* (GebI.) was sometimes found on drained meadows.

Cornumutula quadrivittata semenovi Plav., *Asemum striatum* (L.), and other species sometimes colonize dwarf pine thickets (*Pinus pumila*), which are extensive in the eastern tundra.

The foregoing notwithstanding, the fauna of long-horned beetles in the tundra has not been adequately studied. Hopefully the number of species inhabiting this zone will be more accurately assessed as the number of investigations increases.

Forest Zone

The forest zone extends south of the tundra up to 56° N, merging east of the Ob' with the mountain-forest zone, and covers much of

northern Asia. The forest zone mainly comprises coniferous-taiga vegetation (taiga), predominantly spruce (*Picea*), larch (*Larix*), fir (*Abies*), and Siberian pine (*Pinus sibirica*). The southern part of this zone is covered with extensive deciduous forests, predominantly birch (*Betula*), aspen (*Populus*), partly alder (*Alnus*), and here and there willow (*Salix*).

Spruce-fir vegetation forms the main backdrop of black taiga and is characterized by dense crowns and an insignificant undergrowth of aspen, willow, birch, and mountain ash (*Sorbus*). A comparatively large number of long-horned beetles are found in this vegetation, of which the following have been identified:

- | | |
|--|--|
| 1. <i>Rhagium inquisitor</i> (L.) | 12. <i>Molorchus minor</i> (L.) |
| 2. <i>Evodinus borealis</i> (Gyllh.) | 13. <i>Pronocera brevicollis</i> (Gebl.) |
| 3. <i>Acmaeops pratensis</i> (Laich.) | 14. <i>Clytus arietoides</i> Reitt. |
| 4. <i>A. septentrionis</i> (Thoms.) | 15. <i>Monochamus urussovi</i> Fisch. |
| 5. <i>Anoplodera sequensi</i> (Reitt.) | 16. <i>M. sutor</i> L. |
| 6. <i>Judolia sexmaculata</i> (L.) | 17. <i>M. saltuarius</i> Gebl. |
| 7. <i>Strangalia attenuata</i> (L.) | 18. <i>Pogonocherus fasciculatus</i> |
| 8. <i>Spondylis buprestoides</i> (L.) | Deg. |
| 9. <i>Arhopalus rusticus</i> (L.) | 19. <i>Acanthocinus griseus</i> F. |
| 10. <i>Asemum striatum</i> (L.) | 20. <i>Saperda interrupta</i> Gebl. |
| 11. <i>Tetropium castaneum</i> (L.) | |

Among the species listed above, *Monochamus urussovi* Fisch. and *M. sutor* L. are the most critical forest pests. Their larvae develop under bark and in the trunks of rotting trees, while the adults (beetles) feed on bast and damage young viable shoots. *Molorchus minor* (L.), *Pogonocherus fasciculatus* Deg., and *Saperda interrupta* Gebl. inhabit thin shoots and fine stems of undergrowth, their larvae boring under bark and into wood. *Spondylis buprestoides* (L.) and *Asemum striatum* (L.) usually develop in primary roots and rhizospheres of rotting and freshly felled trees.

All the above-listed species are found in maximum numbers in forests ravaged by fires or primary pests, or disturbed by felling or wind-fallen trees. Many of the species (especially those of *Monochamus*) are technically speaking pests, damaging wood in primary depots located close to or in felling areas.

Cedar forests cover vast stretches of plains and mountain regions. They are often intermixed with fir and form cedar-fir belts. The following beetles are rather common in such forests:

- | | |
|---|--|
| 1. <i>Tragosoma depsarium</i> (L.) | 5. <i>A. smaragdula</i> (F.) |
| 2. <i>Rhagium inquisitor</i> (L.) | 6. <i>A. augusticollis</i> (Gebl.) |
| 3. <i>Evodinus borealis</i> (Gyllh.) | 7. <i>Anoplodera rufiventris</i> (Gebl.) |
| 4. <i>Acmaeops septentrionis</i> (Thoms.) | 8. <i>A. rubra</i> (L.) |

- | | |
|---------------------------------------|--|
| 9. <i>A. sequensi</i> (Reitt.) | 16. <i>M. sutor</i> L. |
| 10. <i>Arhopalus rusticus</i> (L.) | 17. <i>M. saltuarius</i> Gebl. |
| 11. <i>Asemum striatum</i> (L.) | 18. <i>Acanthocinus carinulatus</i>
Gebl. |
| 12. <i>Tetropium castaneum</i> (L.) | 19. <i>Pogonocherus fasciculatus</i>
Deg. |
| 13. <i>Callidium coriaceum</i> Payk. | |
| 14. <i>Clytus arietoides</i> Reitt. | |
| 15. <i>Monochamus urussovi</i> Fisch. | |

Where fir is available, *Monochamus urussovi* Fisch. confines itself to this tree and avoids cedar, while *M. saltuarius* Gebl. and *M. sutor* L. usually prefer cedar. This, to some extent, is an index of host-plant selectivity in these species.

Deciduous forests constitute fragments of the sparse coniferous taiga extending from the Polar Circle to Altai, the Sayans, northern Mongolia, and Manchuria. The population of the long-horned beetle group in deciduous forests is comparatively small. The following are the most typical species found in them.

- | | |
|---|--|
| 1. <i>Rhagium inquisitor</i> (L.) | 13. <i>Callidium violaceum</i> (L.) |
| 2. <i>Gaurotes virginea</i> (L.) | 14. <i>C. chlorisans</i> (Sols.) |
| 3. <i>Acmaeops septentrionis</i>
(Thoms.) | 15. <i>Xylotrechus altaicus</i> (Gebl.) |
| 4. <i>A. smaragdula</i> (F.) | 16. <i>Clytus arietoides</i> Reitt. |
| 5. <i>Nivellia extensa</i> (Gebl.) | 17. <i>Monochamus urussovi</i>
Fisch. |
| 6. <i>Cornumutilla quadrivittata</i>
(Gebl.) | 18. <i>M. sutor</i> L. |
| 7. <i>Judolia sexmaculata</i> (L.) | 19. <i>M. saltuarius</i> Gebl. |
| 8. <i>Anoplodera sequensi</i> (Reitt.) | 20. <i>M. impluviatus</i> Motsch. |
| 9. <i>A. variicornis</i> (Dalm.) | 21. <i>Pogonocherus fasciculatus</i>
Deg. |
| 10. <i>Leptura arcuata</i> Panz. | 22. <i>Acanthocinus carinulatus</i>
Gebl. |
| 11. <i>Asemum striatum</i> (L.) | |
| 12. <i>Tetropium gracilicorne</i> Reitt. | |

Among the most characteristic species of deciduous forests are *Tetropium gracilicorne* Reitt., *Monochamus impluviatus* Motsch., and *Xylotrechus altaicus* (Gebl.). The Altai long-horned beetle [*X. altaicus* (Gebl.)] is monophagous and ranges from the Urals to the Pacific Ocean coast. It attacks viable larch trees; the larvae live under bark, damage the bast, then bore into wood. The last en masse invasion of this pest occurred from 1934 to 1946 in Trans-Baikal. The beetles destroyed 14 to 54% of the mature and even maturing larch stock in some forests. In the intervals between en masse invasions the Altai long-horned beetle usually settles in reconstituted forests. Species of the genera *Tetropium*, *Callidium*, *Clytus*, *Monochamus*, and others usually

colonize dead trees, namely those damaged by the Siberian silkworm (*Dendrolimus sibiricus* Tschetv.), fire, wind, and so forth.

13 *Pine forests* form an extensive front in many regions of the forest zone. They often grow on light loamy soils and sometimes occur in groves. The following species of beetles are comparatively common in pine forests:

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| 1. <i>Tragosoma depsarium</i> (L.) | 13. <i>A. tristis</i> (F.) |
| 2. <i>Rhagium inquisitor</i> (L.) | 14. <i>Asemum striatum</i> (L.) |
| 3. <i>Evodinus borealis</i> (Gyllh.) | 15. <i>Clytus arietoides</i> Reitt. |
| 4. <i>Pachyta quadrimaculata</i> (L.) | 16. <i>Pronocera brevicollis</i> (Gehl.) |
| 5. <i>Gaurotes virginea</i> (L.) | 17. <i>Callidium violaceum</i> (L.) |
| 6. <i>Acmaeops marginata</i> (F.) | 18. <i>Monochamus galloprovincialis</i> Oliv. |
| 7. <i>Anoplodera rubra</i> (L.) | 19. <i>Pogonocherus fasciculatus</i> Deg. |
| 8. <i>A. virens</i> (L.) | 20. <i>P. ovatus</i> Goeze |
| 9. <i>Judolia sexmaculata</i> (L.) | 21. <i>Acanthocinus griseus</i> F. |
| 10. <i>Strangalia attenuata</i> (L.) | 22. <i>A. aedilis</i> L. |
| 11. <i>Spondylis buprestoides</i> (L.) | |
| 12. <i>Arhopalus rusticus</i> (L.) | |

Pachyta quadrimaculata (L.) develops in thin, freshly dried roots of thick-trunked trees; *Arhopalus*, *Asemum*, *Spondylis*, *Anoplodera*, and *Judolia* develop in the roots and basal zone of trunks of dead trees, often in wood stumps; *Acanthocinus*, *Monochamus*, *Rhagium*, and others in tree trunks; *Pogonocherus* in thin branches; and *Tragosoma depsarium* (L.), *Anoplodera virens* (L.), and others often in dead fallen wood. The most serious wood pest among the foregoing species is *Monochamus galloprovincialis* Oliv.

Deciduous (birch, aspen, and mixed) forests in western and eastern Siberia cover the southern fringe of the forest zone, and are extensive here and there. The following species of beetles are often found in birch forests:

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| 1. <i>Rhagium mordax</i> (Deg.) | 10. <i>L. aethiops</i> Poda |
| 2. <i>Anoplodera variicornis</i> (Dalm.) | 11. <i>Strangalia attenuata</i> (L.) |
| 3. <i>Oedecnema dubia</i> (F.) | 12. <i>Necydalis major</i> L. |
| 4. <i>Leptura nigripes</i> Deg. | 13. <i>Xylotrechus rusticus</i> (L.) |
| 5. <i>L. thoracica</i> Creutz. | 14. <i>X. ibex</i> (Gehl.) |
| 6. <i>L. quadrifasciata</i> L. | 15. <i>Cyrtoclytus capra</i> (Germ.) |
| 7. <i>L. arcuata</i> Panz. | 16. <i>Chlorophorus gracilipes</i> (Fald.) |
| 8. <i>L. melanura</i> L. | 17. <i>Acanthoderes clavipes</i> Schr. |
| 9. <i>L. duodecimguttata</i> F. | |

Of these, species of the genera *Xylotrechus*, *Cyrtoclytus*, and *Acan-*

thoderes develop in freshly dried trees; the genus *Leptura* in dead trees—*Leptura quadrifasciata* L. and *L. melanura* L. in the roots, and *L. thoracica* Creutz. usually in the trunks of old dead trees of large girth; *Oedecnema dubia* (F.) in the roots and upturned roots of fallen trees; and *Rhagium mordax* (Deg.) under the bark of dead fallen trees and in the basal trunk zone of dead birch.

Aspen, poplar, and willow forests constitute a single group of wood species of the family Salicaceae. These forests are inhabited by a group of long-horned beetles characterized by rich species composition:

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| 1. <i>Rhagium mordax</i> (Deg.) | 16. <i>Mesosa myops</i> Dalm. |
| 2. <i>Nivellia sanguinosa</i> (Gyllh.) | 17. <i>Rhopaloscelis unifasciatus</i> Kr. |
| 3. <i>Anoplodera variicornis</i> (Dalm.) | 18. <i>Acanthoderes clavipes</i> Schr. |
| 4. <i>Oedecnema dubia</i> (F.) | 19. <i>Leiopus albovittis</i> Kr. |
| 5. <i>Leptura thoracica</i> Creutz. | 20. <i>Exocentrus stierlini</i> Ganglb. |
| 6. <i>L. duodecimguttata</i> F. | 21. <i>Saperda carcharias</i> L. |
| 7. <i>L. arcuata</i> Panz. | 22. <i>S. similis</i> Laich. |
| 8. <i>Necydalis major</i> L. | 23. <i>S. populnea</i> L. |
| 9. <i>Aromia moschata</i> (L.) | 24. <i>S. scalaris</i> L. |
| 10. <i>Xylotrechus rusticus</i> (L.) | 25. <i>S. alberti</i> Plav. |
| 11. <i>X. pantherinus</i> (Sav.) | 26. <i>S. balsamifera</i> Motsch. |
| 12. <i>X. adpersus</i> (Gehl.) | 27. <i>Menesia sulfurata</i> Gebl. |
| 13. <i>Cyrtoclytus capra</i> (Germ.) | 28. <i>Eumecocera impustulata</i> |
| 14. <i>Chlorophorus gracilipes</i> (Fald.) | Motsch. |
| 15. <i>Lamia textor</i> L. | 29. <i>Oberea oculata</i> L. |

- 14 Of the species listed above, *Aromia moschata* (L.), *Xylotrechus pantherinus* (Sav.), *Exocentrus stierlini* Ganglb., *Saperda similis* Laich., *S. balsamifera* Motsch., and *Oberea oculata* L. were detected only on willow, and the rest found on various species of willow, poplar, and aspen. *Saperda carcharias* L., *Lamia textor* L., *Oedecnema dubia* (F.), and *Rhagium mordax* (Deg.) develop on roots and the basal zone of trunks; *Exocentrus stierlini* Ganglb., *Leiopus albovittis* Kr., *Saperda populnea* L., and *Oberea oculata* L. usually on thin shoots; and the rest on tree trunks. Of these, *Saperda carcharias* L., *S. similis* L., *S. populnea* L., *S. balsamifera* Motsch., *Oberea oculata* L., *Xylotrechus adpersus* (Gehl.), and *X. pantherinus* (Sav.) live on viable trees.

Linden forests in western Siberia are distributed as groves and islands. They represent relict flora surviving from the Tertiary period. The largest mass of linden forests is preserved in the Salair ridges in the Kondoma River region. The following beetles were detected in linden trees in these forests:

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| 1. <i>Rhagium mordax</i> (Deg.) | 3. <i>Oedecnema dubia</i> (F.) |
| 2. <i>Anoplodera variicornis</i> (Dalm.) | 4. <i>Leptura arcuata</i> Panz. |

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| 5. <i>L. duodecimguttata</i> F. | 11. <i>Xylotrechus rusticus</i> (L.) |
| 6. <i>L. aethiops</i> Poda | 12. <i>Cyrtoclytus capra</i> (Germ.) |
| 7. <i>L. thoracica</i> Creutz. | 13. <i>Mesosa myops</i> Dalm. |
| 8. <i>L. quadrifasciata</i> L. | 14. <i>Acanthoderes clavipes</i> Schr. |
| 9. <i>Necydalis major</i> L. | 15. <i>Eumecocera impustulata</i> |
| 10. <i>Chlorophorus gracilipes</i> (Fald.) | Motsch. |

All the above species colonize fallen and standing dead trees of linden as well as other deciduous species. In western Siberia long-horned beetle fauna is minimal on linden. This partly supports the view that in the Glacial and post-Glacial epochs the specific fauna of linden forests disappeared more rapidly than the fragmentary Tertiary plant associations which survive in these places even today (Cherepanova, 1972).

The distribution of forest species follows an orderly vertical zoning in the mountains, which serve as an obstacle to the spread of many species of long-horned beetles. Siberian fir rises to a height of 1,700 m, Siberian spruce to 2,000 m, cedar to 2,400 m (forms the upper forest limit), larch to 2,200 m, and Scots pine to 1,400 to 1,500 (rarely to 1,700 m) above sea level. *Monochamus urussovi* Fisch., ecologically associated with fir, rises in the mountains only up to 1,500 to 1,600 m; *Cornumutilla quadrivittata* (Geb.) is encountered in Siberia in woodstocks of Siberian cedar, larch, and spruce up to 2,000 to 2,400 m above sea level. At this height *Asemum striatum* (L.), *Acmaeops smaragdula* (F.), *A. pratensis* (Laich.), *Judolia sexmaculata* (L.), *Arhopalus rusticus* (L.), *Evodinus borealis* (Gyllh.), *Anoplodera virens* (L.), *Tetropium castaneum* (L.), *Callidium aeneum* Deg., *Clytus arietoides* Reitt., *Pogonocherus fasciculatus* Deg., and others are often found. However, long-horned beetle fauna is more diversified in the foothills and midmontane zones of the mountain forest belt up to 1,000 m above sea level, especially in mixed forests with open meadows overgrown with herbaceous vegetation including Umbelliferae, Ranunculaceae, and Rosales on whose flowers adult insects of many cerambycid species feed.

Those long-horned beetles ecologically associated with herbaceous vegetation, usually colonize such meadows in forests in mountains, foothills, and plains. For example, *Brachyta interrogationis* (L.) is highly numerous on the roots of *Paeonia*, *Rhodolia*, and so forth. *Brachyta variabilis* (Geb.), rising to 2,000 m above sea level, lives in the larval stage on the roots of spurge (*Euphorbia*), and is maximum at a height of 400 to 700 m, rising to 1,800 m or more in the mountains.

- 15 *Mixed forests* of the Ussuri-Primor'e region extend from Khabarov and Blagoveshchensk to the Pacific Ocean coast and in the north constitute a special subzone almost up to Komsomol'sk. Here the following have survived since the Tertiary period: oak (*Quercus*), elm (*Ulmus*), maple (*Acer*), Manchurian walnut (*Juglans mandshurica*), linden (*Tilia*),

Amur oak (*Phellodendron amurense*), apricot (*Armeniaca*), kalopan (*Kalopanax*), hornbeam (*Carpinus*), pear (*Pyrus*), mulberry (*Morus*), and other broad-leaved species. Concomitant with these, species of a much later period are found: Korean pine (*Pinus koraiensis*). Manchurian fir (*Abies holophylla*), Korean spruce (*Picea koraiensis*), larch (*Larix*), and so forth. Quite often the Chinese magnolia vine (*Schisandra chinensis*), grapevine (*Vitis amurensis*), and other vines (*Actinidia*) wind around broad-leaved and coniferous species of trees.

The surviving Tertiary flora has created favorable conditions for the existence of Tertiary fauna in which the following species of beetles are the most important:

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| 1. <i>Callipogon relictus</i> Sem. | 24. <i>P. zemlinae</i> Plav. and Anufr. |
| 2. <i>Prionus insularis</i> Motsch. | 25. <i>Xylotrechus pavlovskii</i> Plav. |
| 3. <i>Distenia gracilis</i> (Bless.) | 26. <i>Brachyclytus singularis</i> Kr. |
| 4. <i>Encyclops ussuricus</i> Tsher. | 27. <i>Eoclytus ussuricus</i> (Pic) |
| 5. <i>Gaurotes ussuriensis</i> Bless. | 28. <i>Rhaphuma acutivittis</i> (Kr.) |
| 6. <i>Sieversia bicolor</i> Ganglb. | 29. <i>Teratoclytus plavilstshikovi</i>
Zaitz. |
| 7. <i>Pseudosieversia rufa</i> (Kr.) | 30. <i>Aglaophis colobotheoides</i> Bat. |
| 8. <i>Pidonia debilis</i> (Kr.) | 31. <i>Lamiomimus gottschei</i> Kolbe. |
| 9. <i>P. quercus</i> Tsher. | 32. <i>Monochamus guttatus</i> Bless. |
| 10. <i>P. puziloi</i> (Sols.) | 33. <i>Palimna liturata</i> Bat. |
| 11. <i>Grammoptera gracilis</i> Brancs. | 34. <i>Olenecamptus octopustulatus</i>
Motsch. |
| 12. <i>Strangalomorpha tenuis</i> Sols. | 35. <i>O. clarus</i> Pasc. |
| 13. <i>Anoplodera cyanea</i> (Gehl.) | 36. <i>Moechotypa diphysis</i> Pasc. |
| 14. <i>Leptura femoralis</i> (Motsch.) | 37. <i>Pterolophia ussuriensis</i> Plav. |
| 15. <i>Mallambyx raddei</i> (Bless. and
Sols.) | 38. <i>Asaperda stenostola</i> Kr. |
| 16. <i>Obrium gracile</i> Plav. | 39. <i>Xylariopsis mimica</i> Bat. |
| 17. <i>O. brevicorne</i> Plav. | 40. <i>Leiopus stillatus</i> Bat. |
| 18. <i>Chloridolum sieversi</i> Ganglb. | 41. <i>Eryssamena saperdina</i> Bat. |
| 19. <i>Chelidonium zaitzevi</i> Plav. | 42. <i>Eutetrappa metallescens</i>
Motsch. |
| 20. <i>Rosalia coelestis</i> Sem. | 43. <i>E. sedecimpunctata</i> Motsch. |
| 21. <i>Phymatodes ussuricus</i> Plav. | |
| 22. <i>P. mediofasciatus</i> Pic | |
| 23. <i>P. maaki</i> (Kr.) | |

Some of these species are monophagous and others oligophagous, developing on one or more genetically related hosts. For example, species of the genus *Eutetrappa* mainly colonize linden; *Xylariopsis mimica* Bat.—shoots of the spindle tree; species of the genus *Phymatodes*, *Teratoclytus plavilstshikovi* Zaitz., and *Brachyclytus singularis* Kr.—shoots of grapevine; *Olenecamptus clarus* Pasc., *Chloridolum sieversi* Ganglb., and *Pseudosieversia rufa* (Kr.)—Manchurian walnut; *Moechotypa diphy-*

sis Pasc., *Pidonia quercus* Tsher., and *Encyclops ussuricus* Tsher.—oak; *Sieversia bicolor* Ganglb.—small-fruited trees (*Micromeles*); *Rosalia coelestis* Sem.—Manchurian striped maple; *Callipogon relictus* Sem.—elm, oak, linden, ash, Maximovicz poplar, and others.

The mixed coniferous-broad-leaved forests of islands of the Far East cover the southern regions of Sakhalin, Kunashir, Shikotan, and so forth, and constitute a special category. These forests comprise ash (*Fraxinus*), magnolia (*Magnolia obovata*), oak, maple, phellodendron, elm, grapevine, microsporous spruce (*Picea microsperma*), Sakhalin spruce (*Picea glehnii*), Sakhalin fir (*Abies sachalinensis*), Siebold's walnut (*Juglans sieboldiana*), and others. The characteristic beetle species in these forests are:

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| 1. <i>Distenia gracilis</i> (Bless.) | (Chevr.) |
| 2. <i>Encyclops olivacea</i> Bat. | 21. <i>Paraclytus excultus</i> Bat. |
| 3. <i>Rhagium inquisitor japonicum</i> Bat. | 22. <i>Mesosa japonica</i> Bat. |
| 4. <i>Gaurotes suvorovi</i> Sem. | 23. <i>Plectrura metallica</i> Bat. |
| 5. <i>Pidonia amentata</i> (Bat.) | 24. <i>Pterolophia jugosa</i> Bat. |
| 6. <i>Judolia cometes</i> (Bat.) | 25. <i>Asaperda agapanthina</i> Bat. |
| 7. <i>Anoplodera succedanea</i> (Lew.) | 26. <i>Doius divaricatus</i> Bat. |
| 8. <i>Leptura vicaria</i> (Bat.) | 27. <i>Clytosemia pulchra</i> Bat. |
| 9. <i>L. regalis</i> (Bat.) | 28. <i>Miccolamia verrucosa</i> Bat. |
| 10. <i>L. circaocularis</i> (Pic) | 29. <i>M. cleroides</i> Bat. |
| 16 11. <i>L. latipennis</i> Matsusch. | 30. <i>Exocentrus testudineus</i> Ganglb. |
| 12. <i>L. ochraceofasciata</i> (Motsch.) | 31. <i>Eutetrappa chrysargyrea</i> Bat. |
| 13. <i>Eustrangalis distenoides</i> Bat. | 32. <i>E. chrysochloris</i> Bat. |
| 14. <i>Molorchus kobotokensis</i> Ohb. | 33. <i>Paramenesia theaphia</i> Bat. |
| 15. <i>Stenomolus vulcanus</i> Tsher. | 34. <i>Cagosima sanguinolenta</i> Thoms. |
| 16. <i>Leontium viride</i> Thoms. | 35. <i>Glenea relictata</i> Pasc. |
| 17. <i>Phymatodes vandykei</i> Gress. | 36. <i>Monochamus grandis</i> Waterh. |
| 18. <i>Cyrtoclytus caproides</i> (Bat.) | 37. <i>Megasemum quadricostulatum</i> Kr. |
| 19. <i>Clytus melaenus</i> Bat. | 38. <i>Dihammus luxuriosus</i> Bat. |
| 20. <i>Chlorophorus japonicus</i> | 39. <i>Saperda octomaculata</i> Bless. |

Of these species, the following constitute the basic endemic relict fauna of the islands: *Encyclops olivacea* Bat., *Gaurotes suvorovi* Sem., *Pidonia amentata* (Bat.), *Judolia cometes* (Bat.), *Eustrangalis distenoides* Bat., *Leptura latipennis* Matsusch., *L. ochraceofasciata* (Motsch.), *L. regalis* Bat., *L. circaocularis* (Pic), *L. vicaria* (Bat.), *Molorchus kobotokensis* Ohb., *Paraclytus excultus* Bat., *Pterolophia jugosa* Bat., *Monochamus grandis* Waterh., *Clytosemia pulchra* Bat., *Miccolamia verrucosa* Bat., *M. cleroides* Bat., *Paramenesia theaphia* Bat., *Asaperda agapanthina* Bat., and others.

The fauna of the southern Urals, colonizing relict broad-leaved forests extending into neighboring steppes at the junction of Europe and Asia, represents a special group. These forests mainly consist of linden (*Tilia cordata*), oak (*Quercus robur*), and elm (*Ulmus laevis*). Over 60 species of long-horned beetles are known here, of which *Prionus coriarius* (L.) and *Stenocorus meridianus* (L.) develop mainly in roots of oak and elm; *Rhopalopus clavipes* (F.), *Xylotrechus arvicola* (Oliv.), *X. anthilope* (Schönh.), *Plagionotus detritus* (L.), and *P. arcuatus* (L.)—trunks and shoots of oak and other species; *Anaesthetis testacea* F.—thin branches of oak; and *Exocentrus lusitanus* L.—linden branches. Their ecological concomitants, surviving from the Tertiary period in broad-leaved forests of the Far East, are *Prionus insularis* Motsch. and *Stenocorus amurensis* (Kr.), which live in the roots of oak, elm, and maple; *Rhopalopus speciosus* Plav., *Xylotrechus cuneipennis* Kr., *Plagionotus christophi* Kr., and *P. pulcher* Bless.—mainly on oak trunks; *Anaesthetis confossicollis* Baekm.—thin branches of oak; and *Exocentrus conjugatofasciatus* Tsher.—linden branches. This emphasizes the fact that ecological (including trophic) traits of long-horned beetle fauna are more conservative than morphological features at the level of species differentiation. In the post-Glacial epoch the species composition of long-horned beetles in broad-leaved forests of the southern Urals and the Far East changed significantly, but their ecological grouping at the generic level has persisted to the present day.

Steppe Zone

There is no sharp boundary between forest and steppe zones (Pavlov, 1948). Nevertheless, in western Siberia, for example, there is a transitional subzone—the forest-steppe—covered with extensive forested areas interspersed with open sections that are generally under cultivation today.

In western Siberia the regions of southern Baraba, Kulunda, Kuznets Basin and the low, rounded, isolated hill areas of northern Kazakhstan fall in the steppe zone. Extensive forests of birch, aspen, birch-aspen, and pine prevail in these regions. The vast steppe zone is intersected at many places by protected forest belts of different ages comprising poplar, birch, willow, and here and there larch, pine, and other wood species. The following species of beetles have been found in birch forests:

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| 1. <i>Judolia erratica</i> (Dalm.) | 4. <i>Leptura nigripes</i> Deg. |
| 2. <i>Oedecnema dubia</i> (F.) | 5. <i>Leptura quadrifasciata</i> L. |
| 3. <i>Anoplodera livida</i> (F.) | 6. <i>L. melanura</i> L. |

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| 7. <i>Xylotrechus ibex</i> (Geb.) | 10. <i>Acanthoderes clavipes</i> Schr. |
| 8. <i>X. rusticus</i> (L.) | 11. <i>Saperda scalaris</i> L. |
| 9. <i>Chlorophorus gracilipes</i> (Fald.) | |

Of the foregoing, some species of the genera *Leptura*, *Judolia*, and *Chlorophorus* are quite numerous. The larvae of *Judolia erratica* (Dalm.) live on dead roots of dead or viable thick-trunked birch in sparse forests and the fringe of some forest masses. *Anoplodera livida* (F.) occurs in small meadows along the fringes of birch stands.

Aspen and willow forests of the forest-steppe subzone are colonized by a group of species characteristic of the forest zone. However, *Saperda populnea* L., *S. carcharias* L., and others are seen here in large numbers; they often migrate from natural forests to protected forest belts where, together with other biocenotic constituents, they represent the nucleus of poplar and willow pests.

The group of long-horned beetles ecologically associated with herbaceous vegetation, is the most characteristic fauna of the steppe zone. The following species fall in this category in western Siberia:

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| 1. <i>Agapanthia leucaspis</i> Stev. | 6. <i>P. nigripes</i> Voet. |
| 2. <i>A. altaica</i> Plav. | 7. <i>P. nigricornis</i> F. |
| 3. <i>A. villosoviridescens</i> Deg. | 8. <i>Eodorcadion carinatum</i> F. |
| 4. <i>A. violacea</i> F. | 9. <i>Dorcadion politum</i> Dalm. |
| 5. <i>Phytoecia cylindrica</i> L. | |

Some of the foregoing (species of the genera *Agapanthia* and *Phytoecia*) extend toward open sections adjoining forests, while others (*Dorcadion* and *Eodorcadion*) are seen only in steppes where the grass cover mainly consists of Gramineae.

The Tuva steppes in the upper reaches of the Yenisey are of prime interest. Here, on Gramineae and Gramineae-*Artemisia*-*Caragana* steppes, the characteristic group of steppe and semidesert species of Cerambycidae has evolved historically. This group is represented by the following species:

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| 1. <i>Judolia orthotricha</i> Plav. | 6. <i>E. grumi</i> Suv. |
| 2. <i>Asias tuvensis</i> Tsher. | 7. <i>E. quinquevittatum</i> Hamm. |
| 3. <i>A. halodendri</i> (Pall.) | 8. <i>E. leucogrammum</i> Suv. |
| 4. <i>Eodorcadion carinatum</i> F. | 9. <i>E. lutshniki</i> Plav. |
| 5. <i>E. humerale</i> Geb. | 10. <i>E. ptyalopleurum</i> Suv. |

The long-horned beetles *Judolia orthotricha* Plav. and *Asias halodendri* (Pall.) are found in the southern and northern steppes of Tuva, where they colonize the root sections of *Caragana* sp.; *Asias tuvensis* Tsher. occurs in the central section of the Tuva basin, its larvae living in shoots of *Nanophyton erinaceum*, one of the major components of

the semidesert steppe. *Eodorcadion lutshniki* Plav. and *E. leucogram-mum* Suv. are seen in the central and western parts of the Tuva basin, i.e., east of Chadansk Pass; *E. pytalopleurum* Suv. west of this Pass; and *E. grumi* Suv. south of Tannu-Ol' mountain range. Such localized distribution of these species evidently occurred long ago and has survived to the present day. In the steppes of Trans-Baikal and Ussuri-Primor'e region *Eodorcadion humerale* Gebl., *Agapanthia amurensis* Kr., and *Thyestilla gebleri* Fald. are characteristic. The larvae of the first species live in the turf (Gramineae) and those of the last in the root sections of wormwood (*Artemisia*) stalks.

ECOLOGICAL AND HISTORICAL ASPECTS OF THE EVOLUTION OF CERAMBYCIDS

- 18 Long-horned beetles inhabit deciduous and coniferous forests, large open meadows, steppes, and semideserts. Most of the species are ecologically associated with woods and shrubs and only an insignificant number (*Dorcadion*, *Eodorcadion*, and others) live on herbaceous vegetation in open areas. There is no basis, therefore, to contradict the view that the primary Cerambycidae fauna evolved in close ecological association with forest formations.

Fossils of long-horned beetles have been traced from the Jurassic (Martynov, 1925), Eocene (Piton and Theobald, 1937), and Oligocene (Linsley, 1961) periods; some of these species perished but some genera have survived to the present day. Martynov (1925) has described *Parandexis parvula* Mart. from the Jurassic shales of Kara-Tau. It is assumed that the genus *Parandexis* is close to the genus *Parandra*, which is now extinct.

The cerambycid fauna of northern Asia could presumably have originated from the Jurassic period, but its vigorous growth began roughly in the Oligocene or possibly Eocene. At that time broad-leaved forests predominated in the territory of northern Asia (Krishtofovich, 1936; Pavlov, 1948) comprising oak (*Quercus*), walnut (*Juglans*), beech (*Fagus*), elm (*Ulmus*), hornbeam (*Carpinus*), hazel nut (*Corylus*), magnolia (*Magnolia*), and others; conifers included cypress (*Taxodium*), here and there sequoia (*Sequoia*), pine (*Pinus*), and in the mountains spruce (*Picea*), fir (*Abies*), larch (*Larix*), small-leaved species of poplar (*Populus*), alder (*Alnus*), and others, which gave rise later to mountain-taiga and mixed-forest formations (Tolmachev, 1954). All these forest formations served as an ecological basis for the general lines of evolution of contemporary cerambycid fauna.

The primary fauna of Prioninae, Disteniinae, Lepturinae, Cerambycinae, and Lamiinae evolved in broad-leaved forests. Many of their

representatives have preserved their trophic relations with deciduous species even today (Table 1). The fauna of Spondyliini, Asemmini, Atimini, Monochamini, and some other groups of Cerambycidae evolved in the coniferous mountain-taiga forests, and flourished evidently at the end of the Tertiary and early Quaternary periods.

**Table 1. Distribution of long-horned beetles based on host plants
(in larval stage)**

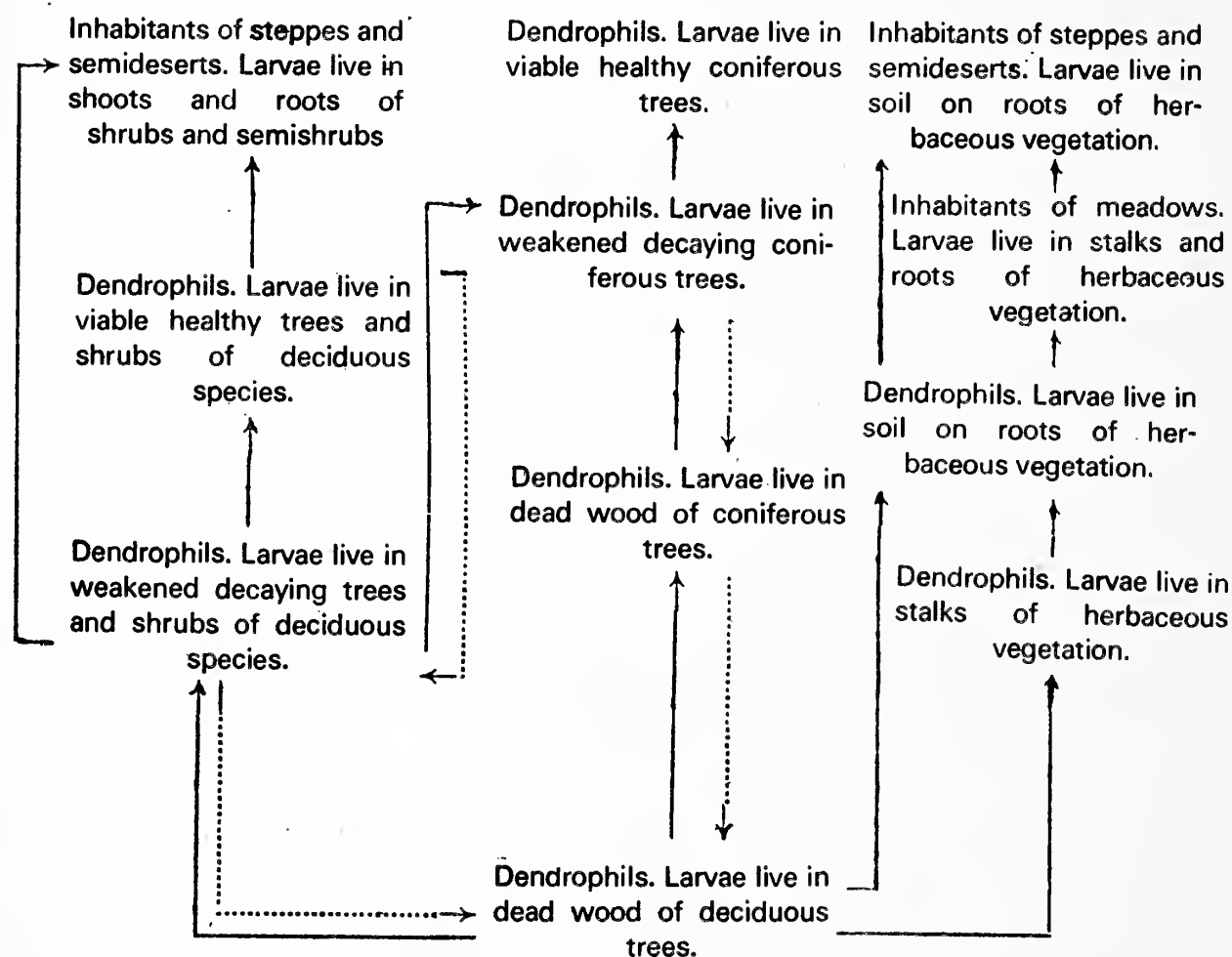
Subfamily	No. of samples	Species found	Species distribution according to plants, %			
			Coniferous	Deciduous	Coniferous and deciduous	Herbaceous
Prioninae	31	4	25.0	75.0	—	—
Disteniinae	16	1	—	100.0	—	—
Lepturinae	2,751	83	34.6	49.4	11.1	4.9
Aseminae	276	11	100.0	—	—	—
Total	3,074	99	40.6	45.8	9.4	4.2

Note: Data from studies of Cerambycinae and Lepturinae will be presented in subsequent volumes.

The colonization of long-horned beetles on deciduous as well as coniferous species evolved gradually—from dead to decaying (physiologically weakened) and finally viable (healthy) trees, i.e., in the early evolutionary phase the fauna colonized dead trees and in the later healthy ones. An indication of the adaptive perfection of long-horned beetles in forest formations is the ability of some [*Chelidonium zaitzevi* Plav., *Xylotrechus altaicus* (Gehl.)] to flourish on viable trees. Such species are of secondary, much later origin. The transition among Cerambycidae from dead to viable healthy trees was accompanied by the evolution of monophagy or oligophagy. All species of long-horned beetles in which the larvae live under bark and in the wood of viable trees usually colonize one or a group of genetically related wood species. For example, *Xylotrechus altaicus* (Gehl.) lives exclusively on larch (*Larix*), *Chelidonium zaitzevi* Plav. on maple (*Acer*), and *Saperda carcharias* L. and *S. populnea* L. on willow (*Salicaceae*).

Another direction in the evolution of Cerambycidae is the transition from wood and shrub species to herbaceous vegetation. Some have adapted in the larval stage (*Brachyta*, *Dorcadion* and *Eodorcadion*) to living in the soil on roots, and some (*Thyestilla*, *Agapanthia*, *Phytoecia*) to stalks of crowfoot (*Ranunculaceae*), spurge (*Euphorbiaceae*), grasses

(Gramineae), Umbelliferae, Compositae, and other herbaceous vegetation. This led some groups of long-horned beetles (*Dorcadion* and *Eodorcadion*) to abandon forest biotopes and take to steppe and semidesert expanses. However, the emergence of long-horned beetles in open forest-free biotopes ceased due to their colonization not only of herbaceous vegetation, but also shrubs and semishrubs. Thus *Asias halodendri* (Pall.) and *Judolia orthotricha* Plav. grow on pea-shrub (*Caragana*) and inhabit the *Artemisia*-Gramineae-*Caragana* steppes of Tuva; *Asias tuvensis* Tsher. lives on *Nanophyton erinaceum* and is found in the semidesert *Nanophyton* steppes of the Tuva basin, and so forth. In the process of adaptation to plant associations a distinct ecological grouping occurred in cerambycid fauna, which can be schematized as follows:



It is evident from this scheme that ecological groups, based on trophic associations in the larval stage, fully reflect the evolutionary interdependence and changeover from one ambient environment to another and vice versa. In the early evolutionary stages (development on dead and decaying stock) ecological groups growing on deciduous and coniferous species were interdependent, a character preserved to this day [for example, *Anoplodera variicornis* (Dalm.), *Chlorophorus gracilipes* (Fald.), *Monochamus urussovi* Fisch.]. Subsequently this evolu-

tional interrelation changed in a unilateral irreversible direction during the adaptation of ecological groups to growth on viable trees, shrubs, semishrubs, and herbaceous vegetation [for example, *Chelidonium zaitzevi* Plav., *Xylotrechus altaicus* (Gehl.), *Asias tuvensis* Tsher., and species of the genus *Eodorcadion*].

At the end of the Tertiary and early Quaternary periods, with the onset of cooling and the formation of Turgai glaciers (Tertiary), the flora retreated southward and many of its constituents faced extinction; simultaneously the highly cold-resistant coniferous, small-leaved, and mixed forests flourished. With the change in vegetative cover, a new Quaternary (Pleistocene-Holocene) fauna, ecologically associated with coniferous and small-leaved formations, came into existence. The nuclei of this fauna formed in eastern Siberia, central Siberia or Yenisey, and Altai-Sayan regions. In this period the Tertiary fauna and broad-leaved forests of Tertiary flora survived by and large only in the Ussuri-Primor'e region, while elsewhere it disappeared altogether or was represented by only certain species.

In the post-Glacial epoch, with the onset of warming, the formation of coniferous and small-leaved forests of eastern and central Siberia and Altai extended in every direction. Concomitantly the Pleistocene-Holocene fauna of Cerambycidae also advanced and penetrated southeast into the Ussuri-Primor'e region, mingling with the Tertiary fauna, intruded into western Siberia and Europe, and southwest came into contact with the Mediterranean fauna. The elements of European-Mediterranean fauna penetrating western and eastern Siberia joined there with the fauna of broad-leaved forests of the Far East. As a result of all these transformations, historically the following natural faunistic complexes arose in northern Asia.

1. Holarctic faunistic complex: Includes species distributed in Eurasia and North America, namely, *Tragosoma depsarium* (L.), *Pachyta lamed* (L.), *Rhagium inquisitor* (L.), *Acmaeops* (= *Gnathacmaeops*) *pratensis* (Laich.), *Judolia* (= *Anoplodera*) *sexmaculata* (L.), *Asemum striatum* (L.), *Arhopalus rusticus* (L.), *Saperda populnea* L., and others.

2. Ussuri-Primor'e relicts of Tertiary origin ecologically associated with broad-leaved forest formations: Over a hundred species are included here, such as: *Callipogon relictus* Sem., *Prionus insularis* Motsch., *Encyclops ussuricus* Tsher., *Sieversia bicolor* Ganglb., *Pseudosieversia rufa* (Kr.), *Strangalomorpha tenuis* Sols., *Anoplodera cyanea* (Gehl.), *Leptura femoralis* (Motsch.), *Obrium brevicorne* Plav., *Chloridolum sieversi* Ganglb., *Chelidonium zaitzevi* Plav., *Rosalia coelestis* Sem., *Phymatodes ussuricus* Plav., *Rhaphuma acutivittis* (Kr.), *Teratoclytus plavilshikovi* Zaitz., *Monochamus guttatus* Bless., *Olenecamptus clarus* Pasc., *Pogonocherus dimidiatus* Bless., *Xylariopsis mimica* Bat., and

Eutetrappa metallescens Motsch. Of these species, *Callipogon relictus* Sem., *Rosalia coelestis* Sem., and a few others are on the verge of extinction.

3. Species complex of eastern Siberian mountain-taiga origin: *Evodinus* (= *Evodinellus*) *borealis* (Gyllh.), *Acmaeops septentrionis* (Thoms.), *A. smaragdula* (F.), *Anoplodera sequensi* (Reitt.), *A. scotodes* (Bat.), *Tetropium gracilicorne* Reitt., *Xylotrechus altaicus* (Gebl.), *Clytus arietoides* Reitt., *Monochamus saltuarius* Gebl., *M. impluviatus* Motsch.,
- 21 *Acanthocinus carinulatus* Gebl., and others. Of these, some colonize the forests east of Yenisey and others inhabit almost all of Siberia, while still others have penetrated Europe. However, all of them are usually more abundant in the mountain-taiga regions of eastern Siberia and partly Altai.

4. Species complex of Altai-Sayan origin: *Brachyta variabilis* (Gebl.), *Acmaeops angusticollis* (Gebl.), *Cornumutilla quadrivittata* (Gebl.), *Nivellia extensa* (Gebl.), *Judolia orthotricha* Plav., *J. longipes* (Gebl.), *Leptura duodecimguttata* F., *Pronocera brevicollis* (Gebl.), *Phymatodes abietinus* Plav. and Lur., *Xylotrechus adpersus* (Gebl.), *Asias halodendri* (Pall.), and others. In the post-Tertiary period some of these extended their range into eastern Siberia, foothills and plains of western Siberia, and also the eastern part of Europe. The distribution of species of this complex is well exemplified by *Cornumutilla quadrivittata* (Gebl.). The long-horned beetles of this species have ecologically adapted to coniferous stock and, together with the latter, cover extensive stretches east up to Yakutia and Shantar Islands, and west the hill ranges up to the Carpathians, Alps, and Tyrol.

5. Species complex of European-Mediterranean origin, penetrating western and partly eastern Siberia: *Rhagium mordax* (Deg.), *Acmaeops collaris* (L.), species of the genus *Cortodera*, *Anoplodera livida* (F.), *Leptura melanura* L., *Obrium cantharinum* (L.), *Aromia moschata* (L.), *Xylotrechus rusticus* (L.), *Plagionotus floralis* (Pall.), *Anaesthetis testacea* F., *Tetrops praeusta* L., and others. These species are widespread, with some ranging up to the Pacific Ocean coast.

6. Faunistic complex of relict endemic insular species inhabiting islands (Sakhalin, Kuril', and others) of the Far East (see above): All these species are ecologically associated with coniferous-broad-leaved forest formations of the Tertiary period.

7. Species complex of the southern steppes: This group comprises species of the genera *Asias*, *Agapanthia*, *Phytoecia*, and others ecologically associated with herbaceous, shrub, and semishrub vegetation. It is quite possible that the evolution of the steppe faunistic complex of long-horned beetles began at the end of the Tertiary period, when steppes with a characteristic steppe fauna prevailed in Mongolia and eastern Kazakhstan (Pidoplichko, 1950; Cherepanov, 1957).

The evolutionary history of faunistic complexes reveals a distinct pattern. Vegetative associations were formed initially, followed by a new faunal composition, sometimes after a long interval, on new plant associations. With the onset of unfavorable conditions, ecological groupings of long-horned beetles disappeared initially and the components of plant associations inhabited by them were eliminated. For example, in Altai remnants of the Tertiary flora, including linden (*Tilia*) survived, but the long-horned beetles ecologically associated with them (*Eutetrappa* and others) disappeared, only to appear later in large number in the Ussuri-Primor'e region. Subsequently, with the onset of successions, the elimination of faunistic complexes of long-horned beetles somewhat outstripped the elimination of the plant associations inhabited by them (Cherepanova, 1972).

Between northern Asia and North America commencing from the Paleogene, there once existed an extensive land bridge across the Bering Strait. At that time, as mentioned before, the climate, flora, and fauna of these two mainlands were more or less identical. Later the land bridge between northern Asia and North America vanished. Thereafter the fauna of these two mainlands evolved independently or in isolation. However, in spite of such a separation the archaic common features of the colonizing fauna have been preserved. Thus today the similarity between northern Asian and North American fauna is 63% tribe-wise, 39% generically, but only about 2.0% specifically.

- 22 Interestingly, the trophic relationships of members of some taxa characteristic for both continents are quite conservative. For example, species of the genus *Encyclops* inhabiting eastern Asia and North America grow on oak (*Quercus*), while species of the genus *Atimia* inhabit juniper (*Juniperus*). In spite of their long separation the species of these two genera preserved their host specificity for the same wood species.

The similarity of Cerambycidae fauna between the mainland and the Far East islands is 87% tribe-wise, 75% generically, and about 35% specifically. It is well known that the isolation of the Far East islands occurred somewhat later than the separation of the Asian and North American mainlands (Gol'tsov-Bezyuk, 1972; Kulakov, 1972). Therefore, the relative similarity between the fauna of the northern Asian mainland and that of the Far East islands at the level of lower taxa (species and genera) is somewhat greater than the similarity between northern Asian and North American fauna. However, it should be remembered that rivers often transport trees infested with cerambycid larvae from the mainland to the sea, which are frequently cast ashore on nearby islands. The larvae surviving in the wood develop normally, pupate, and a cerambycid population arises at the new site. Thus on

Kunashir Island we found in tree trunks cast ashore live larvae, pupae, and adult insects of *Leptura circaocularis* (Pic), *L. regalis* (Bat.), *L. vicaria* (Bat.), *Anoplodera succedanea* (Lew.), and others. In a section of spruce trunk 2.07 m long and 30 to 39 cm in diameter, we recovered, 305 live larvae, pupae, and adult insects of *Leptura circaocularis* (Pic). Larvae of other species were rare. The transmission of long-horned beetles via marine streams occurs more often over short distances—from the mainland to nearby islands and between adjacent islands (for example, between Kunashir and Hokkaido), and less often between the mainland and distant islands. In the latter eventuality the larvae perish due to prolonged incarceration in wood highly saturated with moisture.

CHARACTERISTICS OF INTERSTADIAL DEVELOPMENT

The mode of life of insects in different stadia undergoing transition from one stage to another in conjunction with definite ecological conditions, reveals common directions in interstadial development as well as characteristic features of the life cycle of each individual species. Considerable information has been gathered in recent decades on the mode of life of long-horned beetles. The following publications in Soviet literature may be mentioned: Kiseleva (1926), Plavil'shchikov (1932), Selishchenskaya (1935), Samoilov (1936), Zolotarenko (1960), Ivliev (1966), Krivolutskay (1961, 1966, 1973), Kostin (1973), A.I. Cherepanov (1946, 1952a-b, 1956), and A.I. Cherepanov and N.E. Cherepanova (1971-1978). Among works published abroad on the biology of long-horned beetles, the following merit attention: Demelt (1966, 1971), Funke (1957), Schlotke (1945), Kojima and Hayashi (1969), Duffy (1953, 1968), Craighead (1923), Starzyk (1968), Linsley (1961-1964), Linsley and Chemsak (1972, 1976).

We conducted long-term studies on the biology of long-horned beetles in the field and under laboratory conditions. These led to an understanding of the characteristic features of the mode of life of these insects, identification of the general parameters of interstadial development, and provided a basis for theoretical principles and the resolution of some problems of practical importance.

Life of Adult Insects

- 23 Based on developmental periods in nature, long-horned beetles can be divided into phenological groups. One group comprises *Eustrangalis distenoides* Bat., *Atimia nadezhdae* Tsher., *Mesosa myops* Dalm., *Xylariopsis mimica* Bat., *Doius divaricatus* Bat., *Pterolophia jugosa* Bat.,

Eryssamena saperdina Bat., and other species in which the beetles appear at the end of summer and retire for the winter. In the following spring, usually in May, they emerge from hibernation, feed, and the female oviposits. Supplementary feeding is an essential condition for reproduction among hibernating beetles.

The next group comprises species [*Evodinus borealis* (Gyllh.) and others] in which the adults emerge in early spring. About one week later (usually in May or early June) they leave the breeding site, feed immediately, and subsequently reproduce. The period of active reproduction usually ceases mid-July. However, some individuals survive until the following winter in the pupal stage, others in the prepupal stage.

Most species (subfamilies Lepturinae, Cerambycinae, and Lamiinae) belong to that group in which the adult insects emerge mainly in June, exit from the pupal cell in the last few days of June or in early July, with maximum numbers occurring mid-July. Active reproduction commences in the first 10 days of July and ceases mid-August. Some commence reproduction without supplementary feeding.

Finally, a special group (*Monochamus urussovi* Fisch., *Saperda carcharias* L., and others) is characterized by a prolonged flight period. Adults emerge in June and July and are evident up to September inclusive. Reproduction commences mid-June and ceases in the second half of September. The beetles of this group require supplementary feeding.

The need for supplementary feeding by adult insects depends on their physiological condition and the degree of gonadal development. The varying physiological state of emerging beetles and their host relationships make division of the entire Cerambycidae family into two large groups possible.

Group I comprises species in which the adult insect emerges with underdeveloped gonads. Several Lamiinae (Dorcadionini, Monochamini, Saperdini, and others), some Lepturinae, Aseminae, and others are included here. The adults of this group generally feed on the plant tissues of those host species inhabited by the females. The beetles of *Monochamus urussovi* Fisch. and *M. sutor* L. nibble at the bark of young coniferous shoots, more rarely birch; *Saperda carcharias* L.—leaf tissues and bark of thin shoots of viable poplar, aspen, and willow; *Eodorcadion*—leaves of green cereal grasses; *Saperda alberti* Plav. and *Menesia sulfurata* Gebl.—tissues of green leaves of viable trees; *Mesosa myops* Dalm. and *Rhopaloscelis unifasciatus* Bless.—bark of thin shoots of dead deciduous trees; and so forth. The gonads mature during the feeding period and the beetles start to reproduce thereafter. In some species of the genera *Monochamus*, *Saperda*, and others, the beetles often require a second (regenerative) feeding after oviposition.

Group II comprises species in which the adults emerge with developed gonads and are capable of reproduction without supplementary feeding. Mainly representatives of the subfamilies Lepturinae and Cerambycinae are included here, which can be divided into two subgroups. One subgroup includes species of the genera *Xylotrechus*, *Cor-*
 24 *numutilla*, and a few others. The adults of this subgroup lead a cryptic mode of life, do not feed, and immediately on exiting from the pupal cell mate and oviposit. The beetles of these species [*Xylotrechus altaicus* (Geb.) and others] require only water, which is readily obtained at the oviposition site from dewdrops, raindrops, etc. The longevity of the beetles in this subgroup is two weeks on the average, rarely three to four.

The second subgroup consists of several species of the genera *Anoplo-*
dero, *Leptura*, *Strangalia*, *Chlorophorus*, and others. Their adults live in the open and are found on flowers of Umbelliferae, Rosales, legumes, and other plants from which they gather pollen, and very rarely damage flower petals. They mate on these plants per se, after which the female flies to the oviposition site. Some species (*Anoplo-*
dero, *Leptura*, *Strangalia*) inhabit dead or decaying trees, while others (*Agapan-*
panthia, *Brachyta*) live on herbaceous vegetation. The beetles of these species are more active in warm clear weather and most numerous on flowers from 10:00 a.m. to 8:00 p.m., hiding in grass or soil bedding after sundown. The longevity of the beetles of this group is four weeks, rarely six to eight.

Oviposition is accompanied by complex behavioral reactions in the female, which ensure selection of conditions best for the development of a new generation. The sites chosen for oviposition, like the female's behavior, vary widely. Females of some species oviposit on decaying or dead roots of various trees, for example, *Prionus insularis* Motsch. (oak, maple, and other deciduous species), *Pachyta quadrimaculata* (L.) (pine), *Pachyta lamed* (L.) (spruce), *Judolia erratica* (Dalm.) (birch), and so forth. The female selects a root site, burrows into the soil, lays her eggs on the roots singly, rarely in batches, and repeats this performance until all the eggs are laid.

Another (second) large group of long-horned beetles oviposits in bark crevices and wood fissures of dead trees. This group comprises several species of the subfamilies Lepturinae, Cerambycinae, and Lamiinae. The female initially probes a fissure in the wood or bark with her ovipositor before commencing oviposition. Eggs are generally spaced out singly. However, I did on one occasion observe a female *Sachalin-*
nobia koltzei Heyd. ovipositing 46 eggs one after the other in a heap in a wood fissure at the basal region of a tree trunk. Females of some species of the genera *Anoplo-*
dero, *Xylotrechus*, and others quite often

oviposit under strips of lichens on trees with smooth bark (aspen, poplar, and so forth). The female *Xylotrechus altaicus* (Gehl.) oviposits in bark fissures only on the southern warmer side of viable deciduous trees; the northern exposed side remains uninhabited.

Group III comprises species in which the female makes an incision in the bark of shoots with her mandibles, then oviposits singly, more rarely in twos, under the bark through this slit. This group includes many species of the subfamily Lamiinae. The type of incision varies from species to species. For example, the cuts made by beetles of the genera *Monochamus* and *Moechotypa* are infundibular and often slightly elongate; those made by beetles of most species of the genera *Saperda*, *Oberea*, and others resemble pinholes, while those made by the female *Saperda populnea* L. on the bark of thin shoots are horseshoe shaped.

Group IV constitutes a special group of species, including members of the genera *Obrium*, *Stenhomalus*, *Purpuricenus*, *Amarysius*, and *Asias* in which the female initially glues the egg to the bark shoot, then covers the top with fine fibers (scales) scraped priorly from the bark surface by means of a special brush located ventrally at the tip of the abdomen. Such eggs are difficult to detect.

The female of *Chelidonium zaitzevi* Plav. lays her eggs singly atop thin shoots up to 3.0 mm in diameter only on viable maple trees.

- 25 Shoots of dead trees are totally ignored. The female of *Callipogon relictus* Sem. laid eggs under laboratory conditions in such a manner that they were glued upright on the bark surface.

Fecundity varies considerably. In many species of the genera *Anoplodera*, *Leptura*, and others, the female is capable of laying a large number of eggs in her lifetime. Dissection of females revealed 127 [*Anoplodera virens* (L.)] to 449 eggs [*Anoplodera rubra* (L.)] in the ovaries. High fecundity is characteristic of beetles growing on dead wood.

Larval Life Cycle

The incubation period of the egg depends on the season of the year, temperature, and ambient moisture. Eggs laid in May to early June and also in August develop under low temperature conditions, while those laid at the end of June–July are exposed to very high temperatures. Larvae hatch in the first case at the end of June or in the first 10 days of July, and in the latter case in the last 10 days of July or in August. Larval hatching is generally completed by autumn. Well into this season the eggs of only a few species (e.g., *Saperda carcharias* L.) are seen, namely, those from which larvae have not hatched. Such eggs perish under low temperatures.

Newly formed larvae cut through the anterior cranial end of the eggshell (chorion), emerge, then bore into the tissue of the plant on which they have hatched. Larvae that do not emerge from the eggshell generally die and the shell is usually filled with fine frass. The behavior of I-instar larvae varies markedly from one species to another.

Larvae of the genera *Prionus*, *Stenocorus*, *Brachyta*, *Pachyta*, and others are capable of rapid advancement through very fine holes in the soil and finding there roots of plants they require. Larvae of many species of the subfamilies Lepturinae, Cerambycinae, and Lamiinae colonize the trunks of decaying trees, initially live under the bark, and bore into wood only in the second or third instar. However, larvae of *Rhaphuma acutivittis* (Kr.) and *Rosalia coelestis* Sem., inhabiting trunks of dead trees, bore immediately into wood, leaving very minute inlets on the surface plugged with frass. Larvae of *Encyclops ussuricus* Tsher. and *Pidonia quercus* Tsher. live in the bark of thick-trunked viable oak, making meandering galleries in the bark without touching the bast.

The behavior of larvae of *Xylotrechus altaicus* (Gehl.), living on viable larch trees, is the most characteristic. On hatching the larva bores into the bark layer, reaches the bast, nibbles depressions in it (resembling punctures), then returns to the bark layer, plugging the gallery behind with frass. This procedure is repeated several times and consequently the bast dries. The larva then penetrates under the bark, damages the bast, and makes a gallery across the axis of the trunk that is deeply impressed in the alburnum. In the second year such larvae bore into wood, make galleries tangentially in the opposite direction, and remain here for the second hibernation. They pupate at the end of May or in June of the following year in cells cut in the top layer of wood (Cherepanov, 1946, 1952b).

No less novel is the mode of life of the larvae of *Chelidonium zaitzevi* Plav. On hatching from eggs laid atop thin shoots of viable maple this larva bores into the pith, makes a long longitudinal gallery, and nibbles ventilation openings in the sides. Frass is pushed out through these openings so that the gallery remains hollow throughout its length and the larva moves freely from one end to the other (Cherepanov and Cherepanova, 1977).

Species of the genera *Evodinus*, *Gaurotes*, *Acmaeops*, and others from the subfamily Lepturinae constitute another large group. Their larvae live in the bark or under it in primary, secondary, or even tertiary shoots of both standing and felled trees. Some species [*Evodinus borealis* (Gyllh.), *Acmaeops angusticollis* (Gehl.)] develop in conifers, while others [*Gaurotes ussuriensis* Bless., *Acmaeops collaris* (L.)] live in deciduous wood species. The last-instar larva of these species cuts an oval

opening on the bark surface, falls through it to the soil, burrows, and pupates there in the top layer.

Soil inhabitants form a large group. Larvae of the genera *Sieversia* and *Pseudosieversia* live in the soil, with the first found on the thick roots of small-fruited trees (*Micromeles*) and the latter on the roots of Manchurian walnut (*Juglans mandshurica*). The I-instar larvae of *Eodorcadion* live on the rootstock of Gramineae, but later instars migrate in the soil from one plant to another, feeding on the root tissues of herbaceous vegetation. Newly hatched larvae of *Brachyta* often use soil galleries for movement, finding plant roots and boring into them. Larvae of *Brachyta interrogationis* (L.) generally colonize the roots of peony, of *B. variabilis* (Geb.) the roots of spurge, and of *B. eurinensis* (Tsher.) the roots of Gramineae and legumes.

Larvae of all cerambycid species pass through two basic phases during their development. The first phase corresponds to the feeding and growth period, and the second to the prepupal period. The growth phase is more protracted, extending from several months in some species to two to three years or more in others. Growth is very vigorous in the first few months of larval life and gradually slows down toward the end of the first instar. During hibernation larvae exist in a state of cold torpor and suffer a weight loss of 6.7% or more. With the onset of warm weather, they again become active, feed, grow, and increase in weight. Weight reduction occurs once again in the molting cycle. Thus the development of larvae in the first phase exhibits a definite pattern. Before pupation the larva stops feeding and passes into the prepupal phase. This is when it makes a pupal cell, voids the intestinal contents, enters into an initial diapause, and finally pupates. Diapause in some species (*Leontium viride* Thoms.) commences in August and ends in spring of the following year. During the prepupal period larval weight loss may be 30 to 31% of the initial weight. For example, a larva of *Chloridolum sieversi* Ganglb. weighed 956.7 mg before the prepupal phase and 660.5 mg before pupation. Weight reduction recorded during the prepupal phase for larvae of *Anoploclera variicornis* (Dalm.) was 29%, *Leptura quadrifasciata* L. up to 24.4%, and *Xylariopsis mimica* Bat. up to 0.5 to 16.7%.

Ambient moisture conditions exert considerable influence on larval weight variation. Thus, larvae of *Brachyta interrogationis* (L.) transferred from soil with a moisture level of 20 to 25% into one with 2.7 to 3.1%, lost 10.4 to 33.0% weight in 6.0 to 7.0 hrs, and up to 42.5% in 24 hrs. On transference to soil of moderate moisture (up to 25%), they gradually regained weight (Cherepanov and Cherepanova, 1971). This suggests that the larval cuticle has a comparatively high level of water permeability. Hence larvae (*Evodinus*, *Acmaeops*, and others) growing

under bark in low moisture conditions, quite often gain weight on falling on wet soil during the prepupal phase. For example, according to my data, some larvae of *Acmaeops marginata* (F.) that had migrated from under the bark of a dead tree to moist soil, were 12.3 to 12.5% heavier before pupation.

- 27 The process of making a pupal cell takes a larva several days to one to two weeks. Larvae of the genera *Prionus*, *Evodinus*, *Brachyta*, *Stenocorus*, *Pachyta*, *Gaurotes*, *Acmaeops*, *Sieversia*, *Pseudosieversia*, *Dorcadion*, *Eodorcadion*, and others pupate in the top soil layer. The larva assumes a horizontal position and performs energetic spindlelike rotatory movements, which thicken and polish the wall of the cell and make it spherical in shape. When the cell is completed, the larva enters prepupal diapause. Larvae of *Prionus insularis* Motsch. remove large fibers from the gallery in the soil prior to pupation, spread them along the wall of the pupal chamber, then perform spindlelike rotatory movements which cause a large cocoon consisting of fibers mixed with soil to form around the body.

Larvae of the genera *Rhagium*, *Acanthocinus* and others build a cell under the bark or in the top layer of wood, line it with large fibrous frass, perform rotatory movements around the body axis, thereby polishing the cell wall, and only then pupate. Larvae of some species [*Rosalia coelestis* Sem., *Rhaphuma acutivittis* (Kr.)] make pupal cells in the wood, nibble a gallery to the trunk surface, and plug it with frass. Larvae of other species [for example, *Xylotrechus altaicus* (Gehl.)] build cells in the top layer of wood in such a manner that a layer of wood 2.0 to 9.0 mm in thickness remains between the bark and the cell. In such cases the emerging adult nibbles an exit out of the cell.

Larvae of the genera *Agapanthia* and *Phytoecia* live in the stalks of herbaceous vegetation (Umbelliferae, Ranunculaceae, Compositae, Labiatae). They descend to the basal zone for pupation, make a cell there or even in the roots, nibble a gallery toward the surface, plug it with fibrous frass, and then pupate.

Larvae of most species (Lepturinae, Cerambycinae) pupate after the second or third hibernation, but some (*Callipogon relictus* Sem.) only after the fifth, sixth, or seventh hibernation. The duration of the larval stage is highly dependent on ambient moisture. When the moisture of the wood varies from normal, larval development of xylophagous long-horned beetles is delayed, especially under conditions of a moisture deficiency.

The larvae of many species of long-horned beetles (Prioninae, Disteniinae, Lepturinae, Cerambycinae and partly Lamiinae) make galleries in shoots (trunks or branches) of dead trees, damage the wood, and carry fungal spores inside which decompose cellular matter. Thus they promote

soil enrichment with organic matter, accelerate the geochemical cycle in the biocenose, and essentially perform the function of forest cleaners. Concomitantly they are technically recognized as wood pests. Relatively speaking, only a few subfamilies—Cerambycinae [*Xylotrechus altaicus* (Gehl.)] and Lamiinae (*Saperda carcharias* L., *S. populnea* L.) inhabit viable trees and cause severe damage to forest vegetation.

Pupal Development

In terms of duration of pupation the family Cerambycidae can be divided into several groups. The first group comprises species of the genus *Leontium*, some *Brachyta*, *Acmaeops*, *Gaurotes*, and others. Their larvae are ready for pupation by the end of summer–early autumn, enter a protracted diapause, then pupate the following spring.

The second group is larger and includes almost all of the species of the subfamilies Prioninae, Lepturinae, Cerambycinae, and Lamiinae. These larvae pupate in June–early July.

- 28 The third group comprises *Atimia nadezhdae* Tsher., *Xylariopsis mimica* Bat., *Eryssamena saperdina* Bat., *Doius divaricatus* Bat., *Pterolophia jugosa* Bat., *Mesosa myops* Dalm., and some other species. These larvae pupate in July–August and their beetles emerge end of summer–early autumn, retire for winter, and commence reproduction the following spring. A small fraction of the population in some species [for example, *Brachyta variabilis* (Gehl.)] pupates end of summer–early fall and hibernates at the adult stage, while the remaining population hibernates at the stage of last-instar larvae and pupates in May–early June. *Evodinus borealis* (Gyllh.) is an exception; its larvae pupate in soil at the end of the vegetative period, the pupae enter diapause and overwinter, and the beetles emerge early in the following spring.

The duration of pupation depends on atmospheric temperature and moisture in the pupal cells. For pupae of the genera *Pachyta*, *Brachyta*, *Acmaeops*, and others, which develop in the soil, optimum temperatures are 12 to 24°C. An increase in temperature to 20°C leads to pupal mortality and a decrease inhibits development. For pupae of the genera *Strangalia*, *Anoplodera*, *Xylotrechus*, and many others, which develop in wood, optimum temperatures on the southern side of the trunk in May are 8.8 to 12.2°C, June 14.3 to 17.0°C, July 16.4 to 18.7°C, and August 13.0 to 16.2°C; on the northern side the corresponding temperature range is: 7.3 to 12.0°C, 12.2 to 15.5°C, 14.3 to 17.2°C, and 11.0 to 14.3°C (Cherepanov, 1952b). Temperatures are much higher in wood exposed directly to solar rays and lower in shaded wood lying on a soil cover. Low temperatures induce a cold torpor in insects. Pupae of *Evodinus borealis* (Gyllh.) appear in August–early September, then enter

diapause. At this time the soil temperature is 10 to 12°C, gradually falling to -1.2°C in winter. Pupae of *E. borealis* (Gyllh.) do not perish at this temperature and beetles emerge in spring.

Pupal development occurs at 100% atmospheric humidity. Low humidity leads to water loss in the organism, retarded development, and pupal mortality. Proper conditions are best maintained in closed pupal cells, with pupal development disturbed only if the cell is opened. Utmost sensitivity in this regard is seen in pupae of the genera *Brachyta*, *Evodinus*, *Sieversia*, and *Eodorcadion*, but especially in pupae of *Clytus arietoides* Reitt.

The pupal period varies widely. It is short in most species, no more than three weeks, usually 16 to 20 days. Only in some species (the genus *Acmaeops* and others) in which the larvae pupate in cold soil, is it prolonged for four weeks. However, the pupae of *Evodinus borealis* (Gyllh.) develop in nature from the end of August up to May, i.e., for almost eight months. Only under laboratory conditions was the duration of pupation of this species reduced to 101 days.

The weight of a pupa decreases during the course of development. For example, four female pupae of *Xylariopsis mimica* Bat. developed in about three weeks in pupal cells maintained under laboratory conditions. At the commencement of pupation they weighed 246.7 mg and at the end 241.1 mg, i.e., during this period their weight decreased 2.3%. Weight loss increases markedly when pupae remain in open cells and the atmospheric humidity drops to less than 100%.

Some species make horizontal pupal cells, other species vertical ones. In horizontal cells the pupa invariably lies on the dorsal side [*Xylotrechus altaicus* (Geb.), species of the genera *Brachyta*, *Eodorcadion*]. In vertical cells the pupa of some species (*Necydalis*, for example) lies with the head downward, but in other species (*Distenia*, *Agapanthia*) with the head upward. In wood (in longitudinal cells) the pupa lies with its ventral side facing the trunk surface. If the pupa is turned on its axis by 180°, it will commence rotatory movement until its original position is regained.

Young beetles emerging in spring or early summer (many Lepturini, Clytini, and others) abandon the pupal cell in 1.0 to 1.5 weeks, feed, and soon thereafter start to reproduce. Beetles emerging at the end of summer or autumn (*Atimia nadezhdae* Tsher., *Xylariopsis mimica* Bat.) exit from the pupal cell, locate at the hibernation site, then reproduce in the following spring. Beetles of *Phytoecia nigripes* Voet., *P. nigricornis* F., and other species emerging at the end of summer, enter diapause, hibernate in the pupal cell, and abandon it only when spring arrives the following year.

PHENOLOGY AND AGE STRUCTURE OF POPULATIONS

The age structure of long-horned beetle populations¹ is determined by the phenological features and life span of each species individually. Based on developmental periods, long-horned beetles can be divided into several groups.

Group I comprises *Atimia nadezhdae* Tsher., *Brachyclytus singularis* Kr., *Lamia textor* L., *Mesosa myops* Dalm., *Rhopaloscelis unifasciatus* Bless., *Doiis divaricatus* Bat., *Pterolophia jugosa* Bat., *Eustrangalis distenoides* Bat., *Xylariopsis mimica* Bat., *Eryssamena saperdina* Bat., and others. The flight of beetles of this group (mating and oviposition) commences in May and ceases in the first half of July. Eggs laid by the beetles are found from May through July. Larval hatching commences end of May and ceases in July. Pupation of larvae generally occurs at the end of summer. Pupae are in evidence up to September. Beetles emerging from cells feed on bark in autumn and retire for hibernation, or do not abandon their cells in winter and emerge only in autumn of the following year. Long-horned beetles of this group hibernate as adults or II-instar larvae. Development follows a one-, two-, or three-year cycle. Sometimes a transition from a one- to a two-year cycle or vice versa occurs.

Group II consists of *Evodinus borealis* (Gyllh.) and possibly other species also. The flight of beetles commences end of May-early June and continues through July. Larvae are seen from end of June through August. Pupation of III-instar larvae occurs end of August or in September. Pupae overwinter and beetles emerge from them in early spring. Larvae of the first year, like the pupae, also hibernate. Development follows a two-year cycle. Transition from a two- to a three-year cycle is possible.

Group III comprises species of the genera *Brachyta*, *Pidonia*, *Stenocorus*, *Acmaeops*, *Oedecnema*, *Leontium*, and others. Development follows a two- or three-year cycle. Hibernation occurs in I-, II-, and III-instar larvae. The larvae are usually ready for pupation by autumn and pupate in early spring after hibernating as II- and III-instars. Pupae are in evidence from early May to mid-June. Young beetles emerge end of May to the first half of June. Beetles fly en masse from the last 10 days of June to mid-July. Eggs are found up to August. Young larvae are seen in July and August.

30 *Group IV* includes most species of the subfamilies Prioninae, Leptu-

¹Text taken from Zhuki-drovoseki ivovykh lesov Sibiri (Timber Borers of Willow Forests of Siberia) (Cherepanov and Cherepanova, 1975b) but supplemented here.

rinae, Cerambycinae, Lamiinae, and others. The flight of beetles of this group commences end of June-early July and ceases end of July or in August. Larvae may hatch in July but mainly do so in August, rarely in September. Hibernation occurs in II- and III-instar larvae, rarely only in II-instar. Pupation of larvae commences end of May and ceases in the last 10 days of June. Pupae are found in cells up to the first few days of July. Development follows a two- and three-year cycle, rarely longer. Among species with a life cycle of several years (*Callipogon relictus* Sem.), larvae hibernate as many as five to six times.

Group V comprises the species *Saperda carcharias* L., *Monochamus urussovi* Fisch., and others. Their flight is quite extended, from the first half of June through September inclusive. Eggs laid by the beetles are in evidence from the second half of June through October. Development follows a two- or three-year cycle.

The groups listed above reflect by and large the diverse life cycles and age structure of populations of different species of long-horned beetles. However, some species may be intermediate between one group or the other. For example, the cerambycid *Brachyta variabilis* (Geb.) hibernates mainly as I- and II-instar larvae. Pupae are seen in spring and thus I could place this species in the third group. But part of the population sometimes follows the development pattern of the first group, i.e., pupae are seen in August and the young beetles, evident in September, overwinter. Some of the population may overwinter as pupae, with beetles emerging in early spring, which is characteristic of long-horned beetles of the second group.

It should be noted that in one and the same population, of the larvae hatching from eggs laid almost simultaneously under the same temperature conditions, some develop in a two-year cycle, others in a three-year cycle, i.e., a lag of one year or more. For example, in the summer of 1971 larvae of *Necydalis morio* Kr. were collected in nature from a dead oak tree. In the laboratory these larvae ceased development in 1974 but one survived up to December, 1977, i.e., its development was delayed by more than three years. A developmental lag usually occurs in larvae with a moisture deficiency in wood. The slow development of larvae in desiccated wood is a common phenomenon in all xylophagous beetles of the family Cerambycidae.

It is evident from the foregoing discussion that the age structure of populations of different species varies in different seasons of the year (Table 2). In long-horned beetles of some species hibernation takes place at the larval stage (I-, II-, and III-instars), in others, larval and adult stages, and in still others, larval and pupal stages. In long-horned beetles of some species reproduction (mating and oviposition) occurs mainly mid-summer (July), in other species in the first half of summer

30 Table 2. Seasonal structure of a Cerambycidae population in a two-year cycle

		Month					
Group	Year of development	May	June	July	August	September	October
I	1st	AEL	AEL	AEL	EL	L	L
	2nd	L	L	L	LPA	PA	A
	3rd	AEL	AEL	AEL	EL	L	L
II	1st	PA	AEL	AEL	EL	L	L
	2nd	L	L	L	LP	LP	P
	3rd	PA	AEL	AEL	EL	L	L
III	1st	LPA	PAE	AEL	EL	L	L
	2nd	L	L	L	L	L	L
	3rd	LPA	PAE	AEL	EL	L	L
IV	1st	L	LPA	PAEL	AEL	EL	L
	2nd	L	L	L	L	L	L
	3rd	L	LPA	PAEL	AEL	EL	L
V	1st	LPA	PAE	AEL	AEL	AEL	EL
	2nd	L	L	L	L	L	L
	3rd	LPA	PAE	AEL	AEL	AEL	EL

Key: A—adult; E = egg; L = larva; P = pupa.

(May–June). Some deviations from this pattern by one or two weeks arise sometimes due to changes in climatic conditions. In an early spring the flight of beetles commences early but with prolonged cold weather is somewhat delayed. Low temperatures in May–June promote an extended duration of flight.

PRINCIPLES OF COMPARATIVE MORPHOLOGY

The morphology of Coleoptera based on the adult stage has been well depicted in the basic monograph of Yakobson (1905–1913) and the importance of his work is acknowledged even today. Reitter (1913) and others have referred to it briefly. The structure of adult insects of the family Cerambycidae has been described in comparatively better detail in the more recent monographs of Plavil'shchikov (1932, 1936, and 1940), and Linsley (1961).

Studies on the morphology of cerambycid larvae, ignoring some minor early works, commenced with the publication of a monograph by Craighead (1923). A morphological description of the larvae of this family of Eurasian fauna is available in several works (Plavil'shchikov, 1932, 1940; Greze, 1936; Duffy, 1953, 1958; Kojima and Hayashi, 1969; Cherepanov and Cherepanova, 1975a; Mamaev and Danilevskii, 1975; and others).

The morphology of cerambycid pupae has been studied to a lesser degree. Brief descriptions are available in the works of Plavil'shchikov (1932, 1936), Duffy (1953), Benham (1969), Cherepanov and Cherepanova (1975), and others. In the present text the morphology of all the developmental stages of the family Cerambycidae (adult, egg, larva, pupa) is described from a comparative point of view, based on my studies in northern Asia.

Adult Insect

Body elongate, invariably much longer than wide, in some (majority of Stenocorini, Lepturini, Dorcadionini, and others) usually stocky, comparatively thick, while in others (some Agapanthiini, Phytoeciini, and others) slender and highly extended (Figure 1).

Head (caput): Large, but not larger than prothorax. Set forward and downward at an obtuse angle to body axis (Prioninae, Lepturinae, Aseminae, and Cerambycinae), or vertically down at a right angle (Lamiinae). Frons set between antennae and lower ocular lobes, flat in some species and convex in others, usually with median longitudinal groove (Lepturinae, Lamiinae) or without it and with long carinae instead (genus *Xylotrechus*). Genae comparatively elongate (in Lepturinae) or short and indistinct (Aseminae). Temples (tempora) bulge behind eyes in Lepturinae, often project wartlike laterally; usually smoothened and barely visible in Cerambycinae and others. Neck (collum) in some species in form of deep cervix, indistinct or lacking in others. Vertex between upper ocular lobes usually flat, often with median longitudinal groove; occiput (occiputium) posteriorly rounded or slopes gently. Eyes (oculi) complex, with large or very small facets, convex, and faintly or markedly emarginate on inner side. In *Tetropium* eyes so emarginated that only small septum occurs between upper and lower lobes, which is not so in the genus *Tetrops*.

Antennae long, often longer than body, generally distinctly longer in male than in female, with 11 to 12 segments, filiform, rarely lenticular, even more rarely serrate. First antennal segment thick, in some groups (*Lamia*, *Monochamus*, and others) with fairly isolated cicatrix at apex; 2nd segment shortest, usually nodose; subsequent segments vary in length; 11th segment sometimes with sharp transverse isthmus.

Mouthparts well developed. Labrum transverse, trapezoidal; anterior margin often emarginate; in some species (Spondylini) labrum poorly developed, small. Mandibles massive, straight or curved, apically sharply produced, in some (Prioninae) crisscross; inner margin smooth or with single denticle, rarely with numerous denticles. Maxillae and labium less developed but with long large palps. Maxillary palps consist

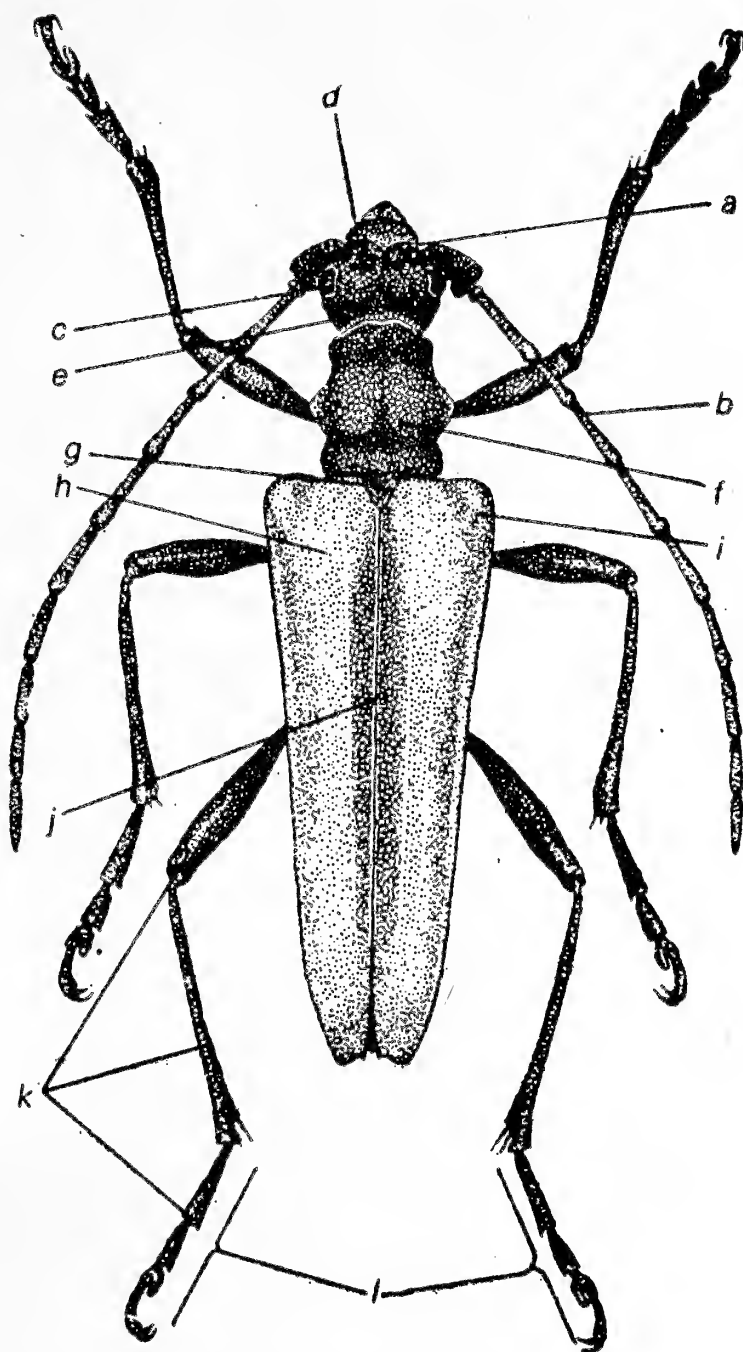


Figure 1. *Stenocorus amurensis* (Kr.), male.

a—gena; b—antenna; c—eye; d—frons; e—temple; f—pronotum; g—scutellum; h—elytron; i—humeral tubercle of elytra; j—elytral suture; k—legs; l—tarsi.

of four or three segments; among Spondyliini generally five adventitious segments present. Labial palps with three segments (Lepturinae, Asemiinae, and others) or two segments (mainly Lamiinae). Last segment narrows toward base, apically straight or obliquely truncate, dolabriform (some Lepturinae, Cerambycinae, and others) or ovally fusiform and apically pointed (many Lamiinae).

Thorax: Prothorax distinct. Pronotum dorsally differs in shape in different groups. For example, in beetles of the subfamily Prioninae pronotum laterally with acute spinescent crenate margin; in Cerambycinae, Asemiinae, and others it is laterally rounded; in Phytoeciini sides parallel. Pronotum often longitudinal, with large or small, dense or sparse

- 33 punctation, and with or without median longitudinal groove; laterally (in many Stenocorini, Monochamini, and others) with conical or spinescent produced tubercle, at anterior margin (in Lepturinae) with transverse flange, and at base often with transverse groove. Prosternum ventrally convex, slopes straightly toward anterior margin or near latter with broad transverse impression; posteriorly, between forecoxae, short or long process (processus intercoxalis) occurs which, in some (Lepturini, Asemini, and others) is narrow and apically pointed, in others (Atimini) broad and flat, broadening apically. Metasternum well developed, with deep median longitudinal groove. Lateral sclerites of thorax (pro-, meso-, and metepisterna) moderately developed, readily distinguished; metepisternum longitudinally elongate, sometimes with coarse dense punctation.

Scutellum represented by exposed portion of mesonotum attached to base of pronotum, triangular, often rounded posteriorly, usually with minute punctation. Elytra attached to anterior margin of mesonotum. They are generally long, rarely short (in Molorchini and Necydalini), and lie at rest on dorsal side. Basally elytra with straight, rarely sloped humeri, on which sometimes a tubercle (callus humeralis) is distinctly evident. Humeri apically rounded, or truncate, or even notched, with minute or large punctation, and with or without projecting longitudinal ridges (carinae). Hind wings (alae) membranous, with reduced characteristic venation, articulate with metanotum, and lie at rest on dorsal side of body; lacking in Dorcadionini and several others. Pro-, meso-, and metasterna posterolaterally with an acetabulum in which leg bases (coxae) are fixed. Coxal cavities and shape and size of coxae vary in different taxa. For example, in some (Callichromini and others) forecoxal cavities are exteriorly concealed, while in others (Rosaliini, Callidiini, Clytini, and others) they are exposed. Forecoxae more or less spherical (Asemini, Hesperophanini, and others) or markedly elongate (Molorchini and others), and so forth. Coxa successively joined by trochanter, femur (at same level and usually thickened toward apex), long slender tibia hinged at an angle to femur, and next to tibia, tarsus (consisting of four segments). Third tarsal segment invariably notched apically. End of last tarsal segment armed with pair of claws (unguiculi) which, in members of Phytoecini, have a minute inner spine. Tibial apex equipped with long acicular spur (calcaria). In long-horned beetles of the tribes Callichromini and Stenaspini scent pores are present on metathorax laterally.

Abdomen: Tapers toward tip, rarely with parallel sides or cylindrical (in some Necydalini). Abdominal sternites convex, with dense or sparse punctation. Abdominal sternite V apically rounded, sometimes emarginate or truncate; in female usually more elongate. Tip of abdomen in

female long-horned beetles of the tribe Acanthocinini produced in form of flat tube, representing a pseudovipositor, which projects from under the elytra. Male genitalia (phallic organs) include phallobase and copulatory organ (penis). Phallobase with pair of elongate parameres and basally common phallosome in which penis located. Parameres usually with tuft of long setae at apex. Ovipositor in female long, apically bifurcate, with pair of lobular appendages bearing setae that vary in number. At rest, male genitalia and female ovipositor invaginated in abdomen.

Egg

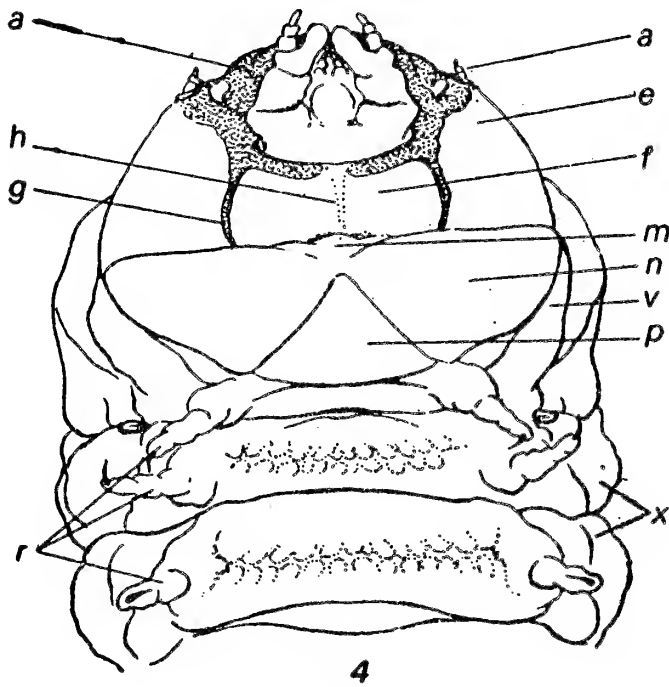
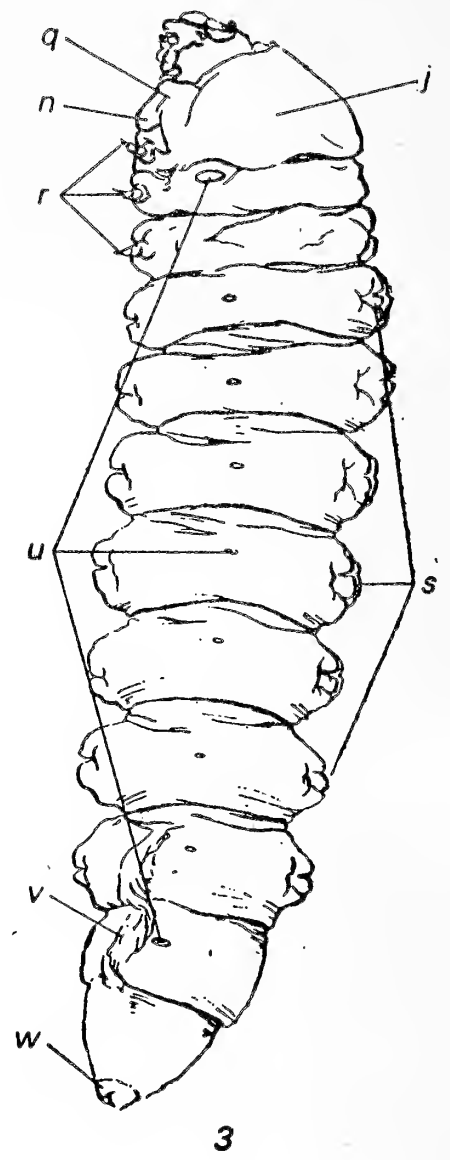
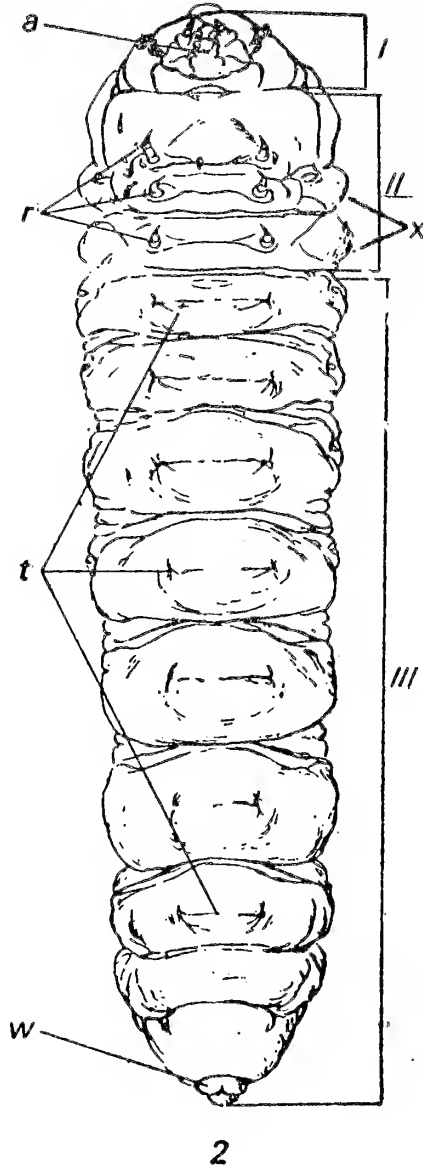
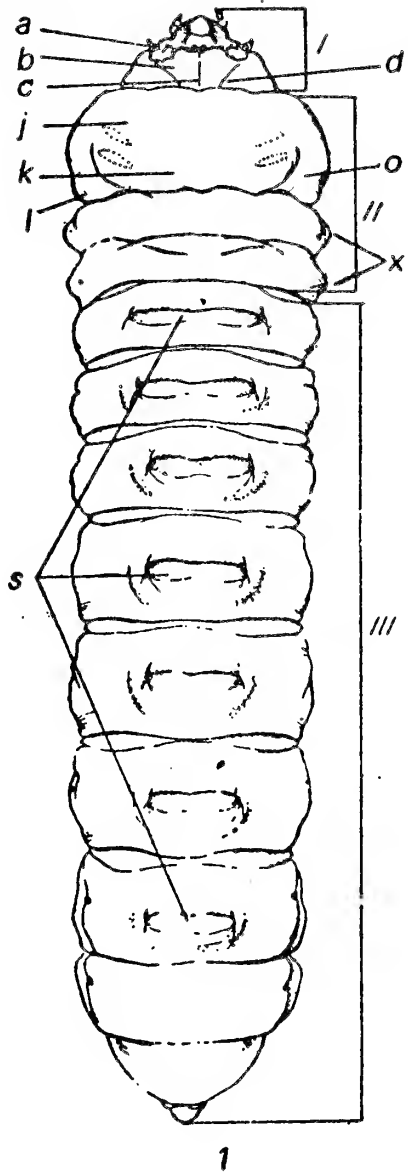
- 34 Elongate, narrower toward posterior (caudal) end where it is usually narrowly rounded or somewhat pointed. Anterior (cranial) end generally obtusely rounded, rarely pointed and rounded. Egg 3.0 to 4.0 times longer than wide. In many Stenaspini it is oval, uniformly broadly rounded at both poles, and considerably longer than wide. Chorion smooth (most Cerambycinae and Lamiinae) or distinctly alveolate (Lepturinae). Cells usually poly- or hexagonal, small, flat or deep, with narrow or broad septa; cells in some species longitudinally elongate and form distinct longitudinal striations. In some Lepturinae alveolate sculpture perceptible only at poles, distinctly smoothened in middle. Color usually white with silvery (Lepturinae) or hyaline sheen. Rarely (*Callipogon*) brownish or (some Stenocorini) greenish.

Larvae

Body moderately or markedly elongate, fleshy, thick (Dorcadionini and others), sometimes comparatively thin (Agapanthiini, Oabriini, and others), usually cylindrical, rarely flat (*Acmaeops* and others), and covered with thin or thick setaceous hairs that form very dense tufts on sides of head (in anterior half), prothorax, and quite often at tip of abdomen (Figure 2).

Head: Consists of cephalic capsule and mouthparts. In larvae of the subfamily Lepturinae head short, transverse, laterally rounded, and barely retracted into prothorax; in Prioninae, Cerambycinae, and others it is usually not wider than long; in Lamiinae it is oblong, with parallel sides, and markedly retracted into prothorax.

Cephalic capsule sclerotized casing that encloses contents of head and is attached posteriorly to prothorax, with mouthparts located in front. Cephalic capsule consists of an epicranium, lateral pleura termed the temporo-parietal lobes, an upper plate (epistomo or frons), and a lower plate (hypostoma). Mouth opening in front and foramen occipi-

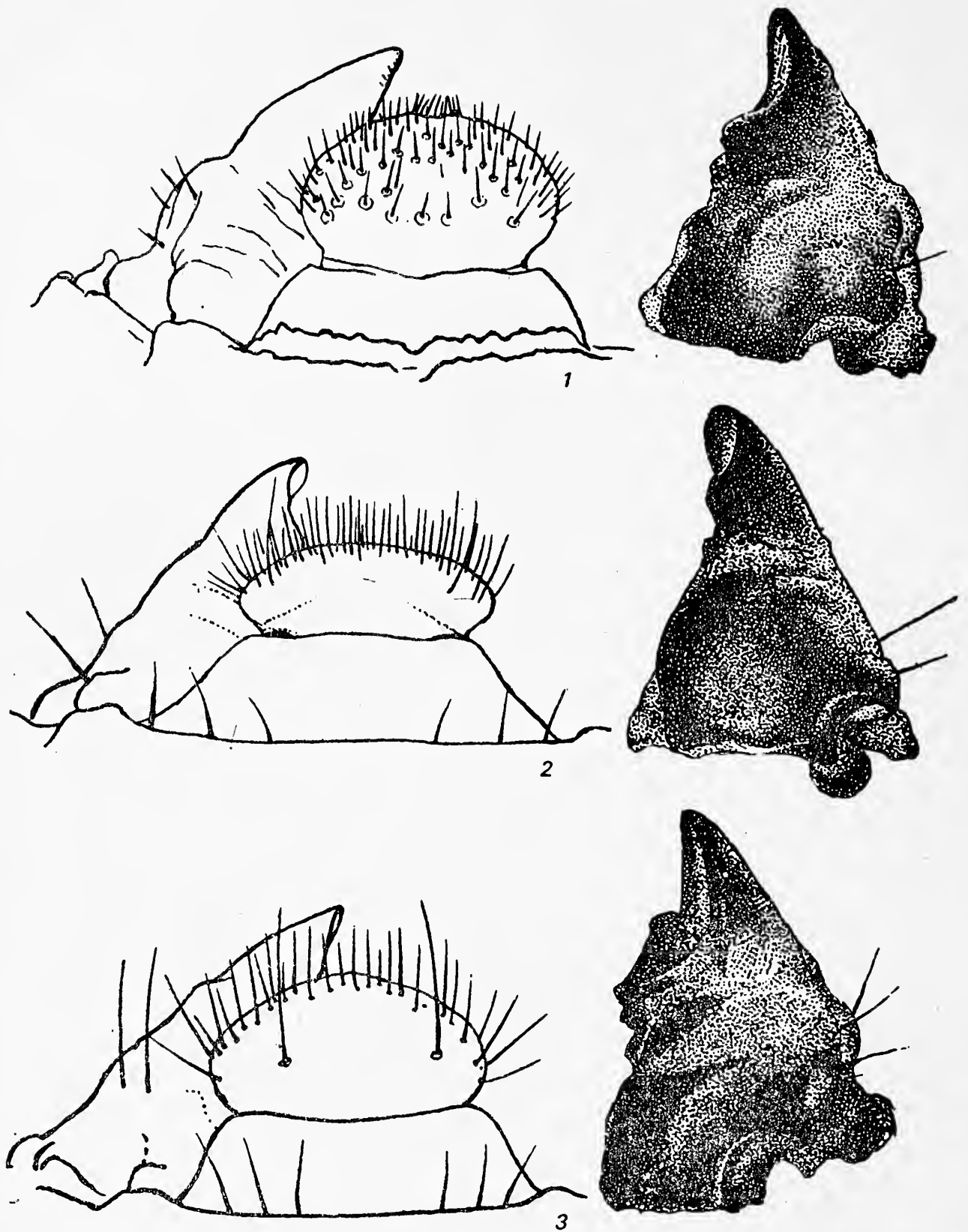


tale posteroventral. In the subfamilies Cerambycinae and Prioninae there are two foramina occipitale: one small (foramen occipitale minor) and one large (f.o. major) posteriorly. Tentorium lies between foramina. In larvae of the other subfamilies only one large foramen occipitale is present. Parietals or sides of head adjoin epistoma dorsally and hypostoma ventrally. Fossa mandibuloarticularis in which is located tuberculus mandibularis, situated on anterior margin of parietals. Antennae located above fossa mandibuloarticularis. Simple pigmented or hyaline ocelli (from one to three) form transverse band behind antennae in several larvae of long-horned beetles of Lepturinae and other subfamilies. Sometimes (*Acmaeops* and others) faintly pigmented or lustrous supplementary ocelli occur, of which two are lateral, receding posteriorly, and one ventral. Dense setae of setaceous hairs generally occur in anterior half of parietals but are absent in posterior half. Epistoma or frons in form of a triangular plate located dorsally between parietals, laterally adjoins whitish frontal sutures (sutura frontalis) and is medially divided by dark brown longitudinal suture (sutura medialis) into two equal sclerites. Frontal sutures in larvae of the subfamilies Prioninae and Aseminae posteriorly meet inner margin of parietals, receding considerably from posterior end of medial longitudinal suture, and hence epistoma looks like a twinned cone. In larvae of Lepturinae frontal sutures merge at posterior end of medial suture, imparting triangular monoapical shape to epistoma. Anteroventral margin of epistoma usually known as the epistomal rand; in some larvae (Prioninae) it projects forward like a rib, with more or less well-developed denticles, and three to six lateral setae; in other larvae (Lepturinae, Cerambycinae, and others) it is smooth, does not project, and lacks denticles. Epistoma, near anterolateral angles, especially in members of the tribes Prioini and Tragosomini, with transverse depression with postcondylar carina. Anterior margin of epistoma with broad dark brown or black border, behind which sparse or abundant setaceous hairs occur, that are usually symmetrical in many Lepturinae; anterior to middle white transverse band joins frontal sutures. Hypostoma or hypostomal plate,

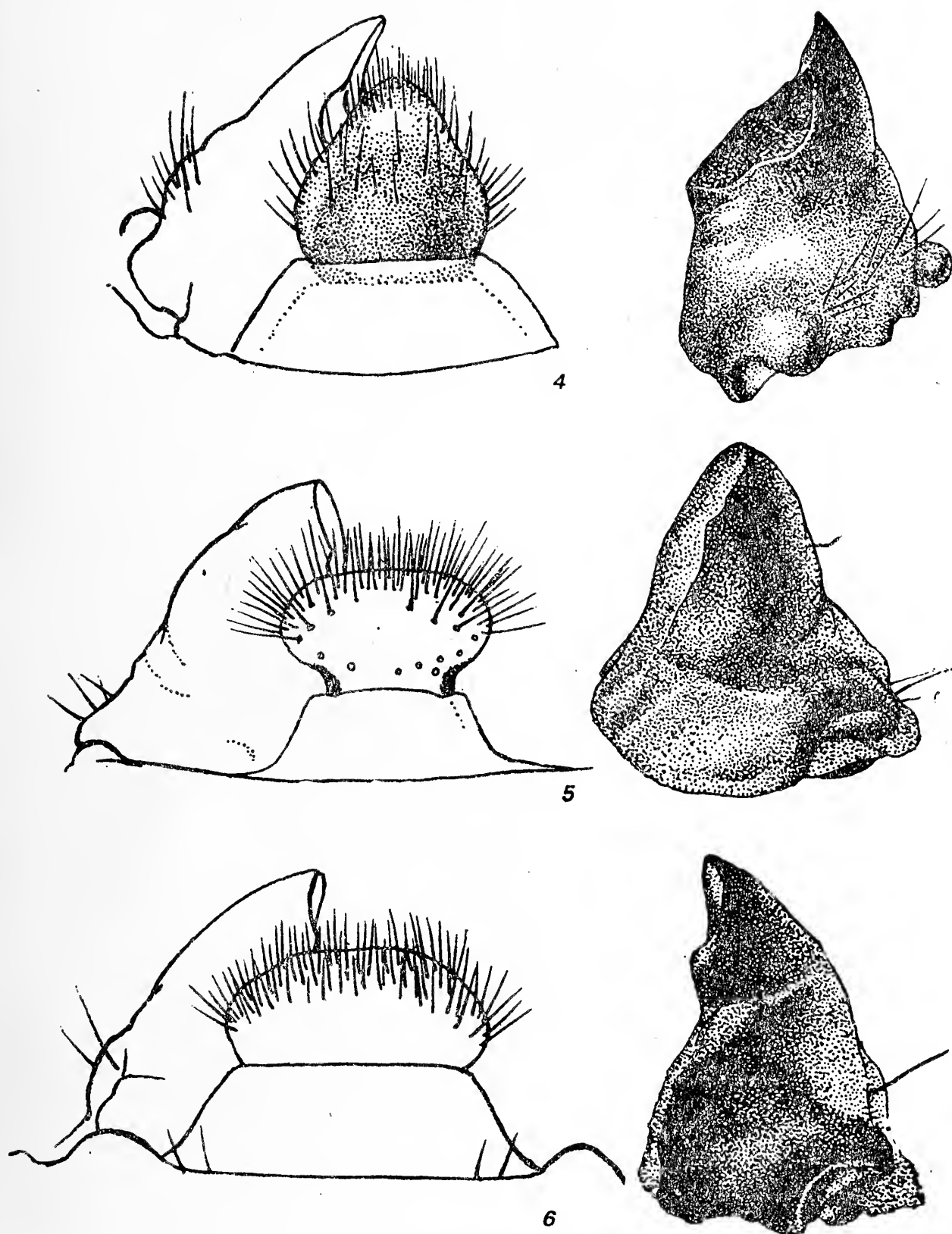
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Figure 2. Larva.

1 to 3—*Tragosoma depsarium* (L.), dorsal, ventral, and lateral view; 4—*Strangalomorpha tenuis* Sols., head and thorax, ventral view. I—head; II—thorax; III—abdomen. a—mouthparts; b—epistoma; c—longitudinal or medial epistomal suture; d—frontal sutures; e—temporo-parietal lobes or pleura of head; f—hypostoma; g—hypostomal suture; h—gula; i—antennae; j—pronotum; k—pronotal shield; l—lateral groove of shield; m—lateral longitudinal folds or alar lobes; n—presternum; o—propresternum; p—eusternum; q—propleuron; r—thoracic legs; s—dorsal locomotory ampullae; t—ventral locomotory ampullae; u—spiracles; v—epipleuron; w—anal lobes.



covering ventral part of cephalic capsule, laterally bound by longitudinal sutures that demarcate hypostoma from lower ventral zone of temporo-parietal lobes. Hypostoma in some larvae (Lamiinae) medially with whitish longitudinal band, in others (Prioninae and Cerambycinae) divided by gula, and broadens toward base into two triangular sclerites. Anterior margin of hypostoma (hypostomal rand) smooth, straight or broadly emarginate, sometimes longitudinally striate (Stenaspini), sometimes with distinct produced tubercles or spines (in some Meso-)



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Figure 3. Labrum, clypeus, and mandibles of larvae.

1—*Prionus insularis* Motsch. (Prioninae); 2—*Distenia gracilis* Bless. (Disteniinae); 3—*Anoplodera rubra* (L.) (Lepturinae); 4—*Megasemum quadricostulatum* Kr. (Aseminae); 5—*Xylotrechus altaicus* (Geb.) (Cerambycinae); 6—*Lamia textor* L. (Lamiinae).

sini); anterior half of hypostoma usually with sparse setaceous hairs, basal half (Lepturinae, Aseminae and Lamiinae) with obliquely transverse dark brown tentorial pits.

Clypeus usually trapezoidal and broad, its base masking most of anterior margin of epistoma, or small (Cerambycinae) and dorsally masks only space between mandibles. Clypeus white, glabrous, lustrous, usually with rusty-brown margin basally, rarely uniformly rusty. Labrum narrows basally, laterally broadly rounded, with rounded anterior margin. In the subfamily Cerambycinae it is round and small; in Lamiinae usually transversely oval and large; in Aseminae elongate, apically produced and pointed, laterally and on anterior margin with short or comparatively long setae, on lower side with short spines, on disk slightly convex, glabrous, whitish, basally rusty-brown, rarely uniformly rusty. Mandibles massive, thick, with cultrate margin of varying structure at apex, and posterolaterally with highly produced clavate mandibular tubercle (*tuberculus mandibularis*), which is located in mandibular fossa (Figure 3). In the subfamily Cerambycinae mandibles short, broadly rounded apically, hollow or scooped out, with sharp cultrate edge extending end to end; in Lamiinae they are comparatively elongate and obliquely truncate at apex; in Lepturinae broadly truncate with markedly produced lower (*dens ventralis*) and small upper (*dens dorsalis*) denticle; in Aseminae inner side of mandibles with longitudinal carinae, upper side clipped around cultrate edge into angular striation, and labrum mounted here with pointed apex. Maxillae paired, poorly sclerotized, coriaceous, segmented, and consist of short basal cardo and much longer stipes, terminating on the inner side in malae, on the outer side with palpiger maxillaris, and with latter divided into two or more often three segments. Outer lower side of stipes and also partly base of palpiger maxillaris with sparse, sometimes coarse setae. Labium unpaired, poorly sclerotized, and coriaceous; consists of basal part or submentum, mentum, and palpiger labiales, with two-segmented palpi labiales, ligula, and apical setae. Submentum basally joined to anterior

37 [sic. = posterior] margin of cephalic capsule; only in the subfamily Disteniinae it is joined directly to anterior margin of prothorax through cervix. Labium and maxillae usually fuse to form composite structure.

Thorax: Consists of three segments—prothorax, mesothorax, and metathorax. Prothorax best developed, usually equal in length to two successive thoracic segments together. Dorsal side of prothorax known as pronotum, convex posterior half of which forms scutum; it is demarcated from alar lobes by lateral longitudinal grooves and joins (in many Lamiinae) inner transverse dents that bind anterior angles of scutum. In larvae of the subfamily Lepturinae lateral grooves are lacking and scutum usually fuses gradually with general surface of pronotum. Pronotal shield whitish, coriaceous, densely rugose (in many Lepturinae) or sclerotized with small spines imparting yellowish-rust shade (in some Cerambycinae and Lamiinae), or with large spines forming an

extensive spinous field (in Saperdini, Gleneini, and Phytoeciini). Sides of prothorax with coriaceous or sclerotized pleural folds (pleurae), sometimes with shagreen sculpture. Ventral side of prothorax (prosternum) divided into: proplesternum—a posteriorly rounded, triangular, white, often glabrous formation; presternum, which occupies much of prosternum, usually covered with dense setaceous hairs; eusternum, that narrows markedly anteriorly, with narrowly rounded anterior margin; and finally, a posterior hinged part (sternellum s. basisternum) to which forelegs are attached. All these divisions of the prosternum are distinctly visible in larvae of the subfamily Lepturinae, but merge or fuse (except for sternellum) into a common surface in larvae of Cerambycinae.

Meso- and metathorax, with corresponding meso- and metanota, distinctly divided by cruciate suture into anterior prescutum, posterior scutellum, and two lateral lobes (parascutum). Meso- and metapleura more or less laterally distinct. Meso- and metasternal sclerites on ventral side separately divided by median transverse suture into anterior eusternum and posterior sternellum, to which middle and hind legs are attached respectively. Spiracles located laterally in mesopleural region, close to anterior margin, are differentiated by larger size from those on abdomen. Coxal sclerites (pre- and postcoxal) are located lateral to coxae and not distinguishable in larvae without legs.

Legs (pedes) attached to pro-, meso-, and metathorax. Well developed in larvae of the subfamilies Prioninae, Lepturinae, and Aseminae; less developed in some Cerambycinae; and lacking in Lamiinae and some Cerambycinae (genus *Xylotrechus* and others). Larval legs consist of a short coxa, small trochanter, much longer and comparatively thick femur, with thick setae sometimes forming an apical collar on inner side, thin extended tibiotarsus, and an unpaired claw (unguis). In some Clytini [e.g., *Chlorophorus gracilipes* (Fald.)] legs are best developed in III-instar female larvae and least developed in male larvae.

- Abdomen*: Elongate, narrowing markedly toward tip (Lepturinae and others) or with parallel sides (Phytoeciini); consists of nine segments and one additional anal tubercle treated as segment X. Each
- 38 segment consists of the following sclerites: dorsal tergite, ventral sternite, and lateral pleura. Locomotory ampullae usually occur on abdominal segments I to VII, rarely on I to VI (some Stenocorini) and even more rarely on I to V (genus *Distenia*). In larvae of *Allosterna*, with a C-shaped body, locomotory ampullae are well developed dorsally (on abdominal tergites I to VII and the metanotum) but lacking ventrally.
- 39 Dorsal locomotory ampullae differ in structure in larvae of various groups. For example, in members of the tribe Stenocorini they are convex, with a common medial longitudinal, sometimes broad groove

divided by narrow transverse grooves that join short lateral longitudinal grooves; as a result the surface of the dorsal ampullae is divided into a short anterior transverse ridge (prescutum), a much larger median ridge (scutum), a posterior transverse fold (scutellum), and lateral folded lobes (parascutum). In some larvae of the subfamily Lepturinae (40 *Judolia*, *Judolidia*) the prescutum, scutellum, and parascutum bear rows of more or less distinct large granules. In other larvae of the same subfamily (*Anoplodera*, *Leptura*, *Strangalia*, *Eustrangalis*, for example), granulation of the dorsal locomotory ampullae is complex: four transverse rows of granules form two transversely elongate sections of ellipses. The same feature, in a somewhat modified version, is seen in members of the subfamily Lamiinae. In larvae of Saperdini the dorsal locomotory ampullae are divided by two transverse grooves, sclerotized (covered with minute spines), but without granules; in the genera *Xylariopsis*, *Pterolophia*, *Anaesthetis*, and others granules are distinct and form two transverse rows; in Monochamini they form three to four rows; and finally, in some species (genus *Monochamus*) the granules are covered with minute spines. This indicates that in the process of evolution sclerotized, nongranulate locomotory ampullae (Saperdini) somewhat preceded granulate ones (Monochamini). In other words, the former are much earlier in origin and the latter much later. In Cerambycinae the dorsal locomotory ampullae are not granulate; in some species (e.g., *Chlorophorus*) they are coriaceous, usually with a single transverse groove; in others (*Aromia*, *Chelidonium*, and *Chloridolum*) they are coriaceous, usually reticulate and striate, with two transverse grooves converging laterally and medially; in still others (e.g., *Xylotrechus*) they are sclerotized, laterally tubercularly convex, without transverse grooves, and only anterolaterally with a cruciate groove or dent. However, in the larvae of even some remote groups (Obriini and Atimini) the locomotory ampullae are conically produced and hence the abdomen appears nodose.

The ventral locomotory ampullae are less convex, divided by a single narrow transverse groove that joins laterally with a short longitudinal groove. In Prioninae they are coriaceous and nongranulate, while in Lepturinae two rows of large, sometimes elongate lustrous granules are present. Various abdominal segments bear structures in the form of lobes, platelets, spinules, and so forth. Thus on abdominal sternite VII in *Semanotus undatus* (L.) a pair of rounded lobes, bent down toward the middle are present. In larvae of *Pogonocherus* a transversely elongate sclerotized strip, sometimes with a single sharp spinule, is distinctly evident on tergite VIII. Abdominal tergite IX of the larvae of some species of Stenocorini (*Rhagium*, *Stenocorus*, *Pachyta*, *Gaurotes*, *Brachyta*, *Evodinus*, and others) has a more or less developed scle-

rotized spinule apically; two spinules are present in Spondyliini, Asemini, and Atimini; in some Molorchini (genus *Nadezhdiana*) there are several spinules forming an extensive spinous field. In larvae of the genus *Tetrops* abdominal tergites IV to VI bear several spinules arranged in a dispersed irregular group.

An anal tubercle with an anal opening is located at the tip of the abdomen, and is usually hemispherical. In most species it is triradial, surrounded by three hemispherical lobes, and exteriorly covered with short or comparatively long setaceous hairs. In larvae of the tribe Lamiini (genus *Lamia*) and often of Disteniini (genus *Distenia*) the anal opening is transverse; in some Monochamini (genus *Monochamus*) a gradual reduction of the lower ray is evident, and as a result the anal opening appears somewhat transverse and slightly bent downward in the middle.

Age variations: These are distinct among the larvae of several species. Generally I-instar larvae have a relatively large head and the body is covered with very long thin hairs. In larvae of the genus *Monochamus* each of the first eight abdominal segments has one lateral sclerotized spinule bent backward, and the mandibles one spinule bent forward. In larvae of the genus *Aromia* abdominal segments II to IV have one long sharp lateral spinule. These larval characteristics disappear on molting
41 into II-instar larvae. However, I-instar larvae of the genus *Evodinus* have no spinule apically on abdominal tergite IX, while this spinule is present in the II-instar.

In larvae of some species [e.g., *Chlorophorus gracilipes* (Fald.)] lobes, usually sclerotized apically, occur laterally on the meso- and metathorax in the last instar before pupation. Occasionally III-instar larvae [*Leptura arcuata* Panz., *L. ochraceofasciata* (Motsch.), *L. nigripes* Deg., *Necydalis morio* Kr., for example] paired pseudopods or spotlike rusty-yellow sclerotized formations occur apically on sternite IX.

Pupa

Body: Glabrous, its appendages free of any secondary attachment. In general, corresponds to the adult (Figure 4). In some pupae (many Stenocorini, Dorcadionini) body thick and coriaceous, in others (Necydalini, Agapanthiini, Phytoeciini) comparatively thin and elongate. Most species (*Pidonia*, *Pseudosieversia*, *Acmaeops*, and others) pupate in soil. Their body is curved more, with the abdominal tip bent downward and distinctly convex dorsally.

Head (caput) bent down (Prioninae) or markedly bent under (Lepturinae and others), with a more or less distinct cervix behind eyes. Frons between antennae flat or broadly depressed (Callipogonini), more

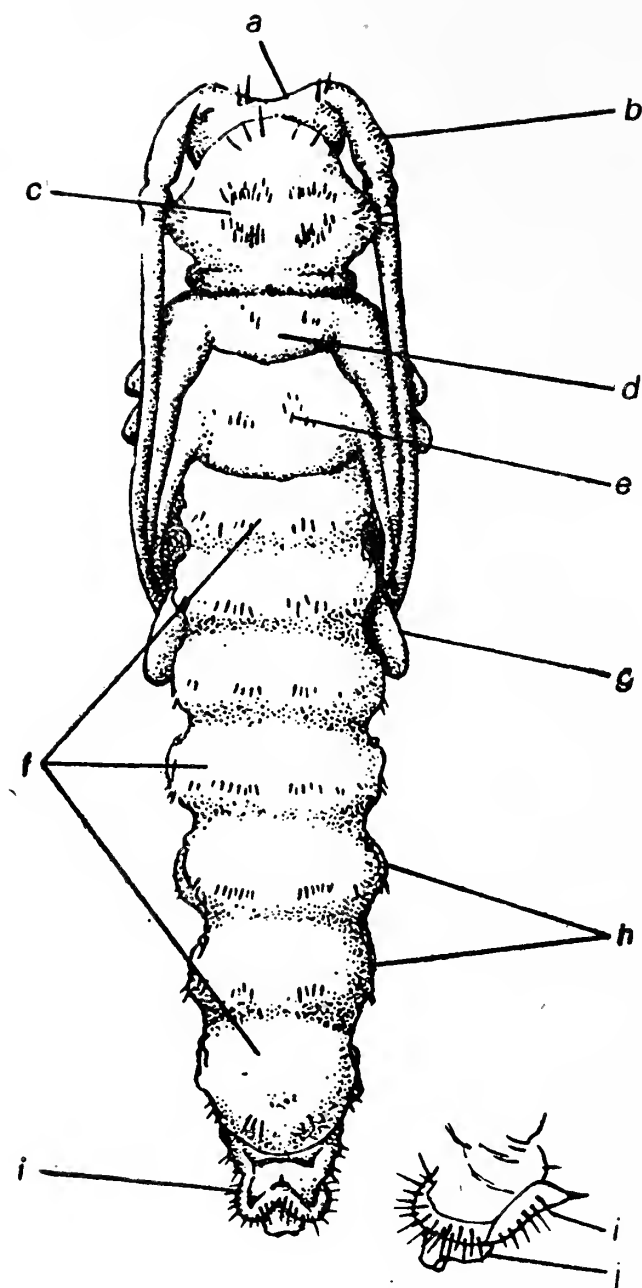


Figure 4. Pupa of *Asaperda stenostola* Kr., dorsal view.

a—head; b—antenna; c—pronotum; d—mesonotum; e—metanotum; f—abdominal tergites; g—hind femur; h—pleural tubercles; i—urogomphi; j—tip of abdomen, lateral view.

often transversely convex, usually with medial longitudinal suture and fairly developed tubercle laterally at base of antennae on inner side (in many Lepturinae and Aseminae), where long setae form longitudinal row or stripe. Paired setae generally form common transverse row along anterior margin at base of clypeus. Genae well developed, often elongate, long (most Lepturinae) or, contrarily, short (Aseminae). Vertex between upper lobes of eyes flat or broadly depressed, rarely with stray setae around posterior margin of eyes. Occiput smooth, spherically rounded, glabrous, without setae (Cerambycinae, many Lamiinae) or with distinctly produced setaceous tubercle on each side

(Lepturinae). Sometimes occipital protuberances with stray or several short sharp spinules instead of setae. Temples slope slightly behind eyes (many Cerambycinae) or steeply (usually in Lepturinae). Antennae directed backward, pressed to sides of body, and extend to middle of abdomen; apices ventrad and either arcuate (many Clytini, Lepturini), spiraled (many Lamiinae) or looplike (Callichromini) (Figure 5). More often, antennae twist independently (individually) and form an independent ring or spiral along each side of body, more rarely (e.g., in Disteniini) a common spiraled ring ventrad. In some groups (Aseminae) antennae laterally with short, sometimes thick spinules, more often without spinules (Lepturinae, Cerambycinae). Mouthparts well developed. Labrum elongate, apically pointed (Callipogonini, Asemini, Spondylini) or slightly elongate, almost transverse, rounded or straightly truncate at apex (Dorcadionini, Monochamini).

Thorax: Distinctly divided into three segments, of which prothorax largest, invariably broader than head. Dorsal side of prothorax (pronotum) in some members of the tribes Callipogonini, Prionini, and Tragosomini slightly convex, and laterally with sharply produced flat margin; in pupae of Stenocorini, Dorcadionini, Monochamini, and others pronotum usually highly convex and laterally with produced, sometimes

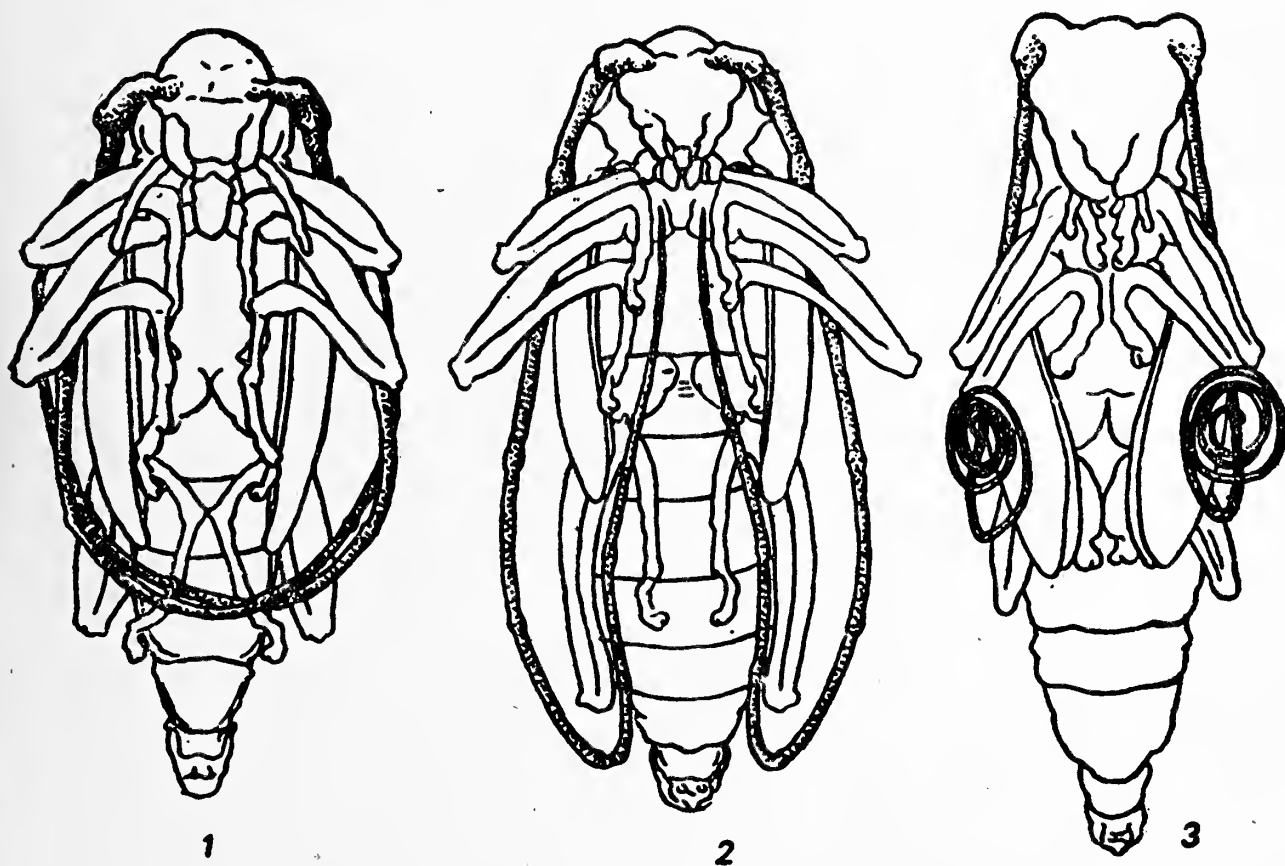


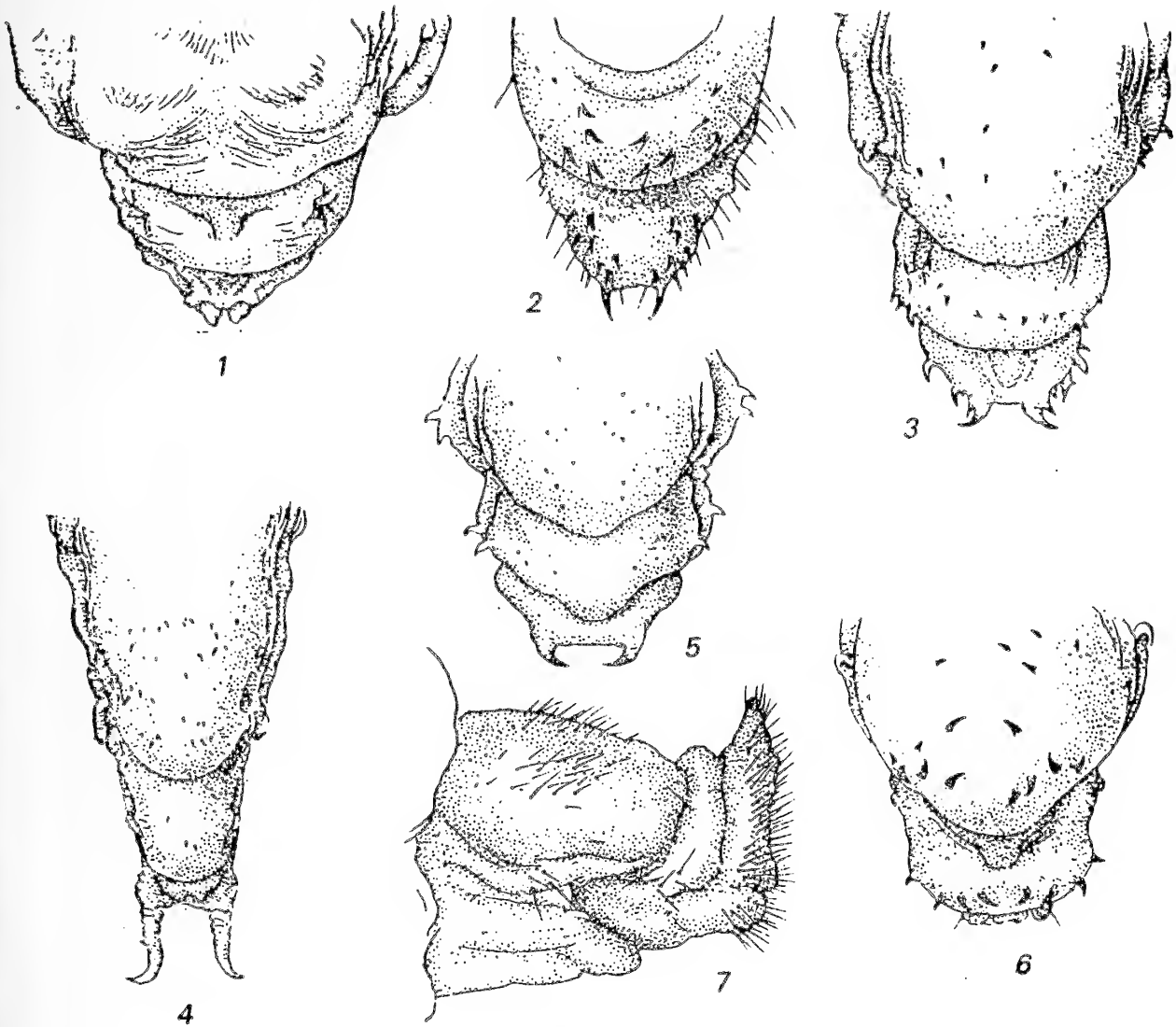
Figure 5. Pupae, ventral view.

1—*Distenia gracilis* Bless. (Disteniini); 2—*Chloridolum sieversi* Ganglb. (Callichromini); 3—*Olenecamptus clarus* Pasc. (Dorcaschematini).

very sharp and conical tubercle; in Clytini pronotum highly convex, laterally rounded and without tubercle; in many Lepturini narrows markedly toward front, with deep transverse flange on anterior margin, produced posterior angles, and often with coarse setae or spinules that form transverse stripe or row, usually posterior, rarely on anterior margin and disk. In many Lepturinae setae set on protuberant coriaceous base. Mesonotum comparatively small, posteriorly with produced, slightly elevated scutellum, sometimes (Lepturinae) with stray spinules or setae. Metanotum flatter, only slightly convex, with median longitudinal groove, and laterally, away from groove, and usually in posterior half, often (especially in Lepturinae) with setae or spinules that form two more or less large groups; in some Stenocorini these setae are located on a tubercular elevation.

Apices of elytra and hind wings bent ventrad, flexed to body, and cover middle part of femur on the outer side. Legs seen in bent position; forelegs and midlegs flexed to metathorax and hind legs to ventral side of abdomen. Tarsi of all legs directed backward and form two parallel lines. Femora of hind legs extend along abdomen or markedly flexed dorsally. Latter position more common in species (many Stenocorini) pupating in soil, since the hind femora provide additional support to the pupa. Apices of femora laterally with setae or spinules that usually form a transverse row or "collar". Such setae are absent in Cerambycinae and some Lamiinae (Dorcadionini).

44 *Abdomen:* Nine tergites of different types, six sternites, and lateral pleurites distinguishable. Abdomen narrows gradually from base to tip, often enlarges in region of segments III to V. Abdominal tergites convex, in posterior half elevated more, laterally sometimes flat, and in middle with more or less distinct longitudinal groove; spinules or setae often set on produced coriaceous base and form transverse row or stripe or more compact paramedial group. Spinules on abdominal tergites VII to VIII large and distributed uniformly in many Cerambycinae; contrarily, usually comparatively small and often absent in Lamiinae and others. Abdominal sternites less convex, glabrous, with neither spinules nor setae, rarely with spinules or setae, and in some Aseminae laterally with tubercular protuberance covered with setae or minute spinules. Pleural tubercles on sides of abdomen with one to two coarse setae or spinules directed backward. Abdominal segments I to VI dorsally, in or near pleural region, with circular or transversely oval spiracles. Tip of abdomen obtuse, rounded laterally like a carina (in dorsal view), horseshoe shaped, or triangular. Lateral carina covered with setae or spinules. Urogomphi usually terminate in sharp sclerotized apical spinule on dorsal side. Urogomphi absent in Callipogonini; in form of widely separated long spinules in Tragosomini; usually small, widely



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Figure 6. Tip of abdomen in pupae.

1—*Prionus insularis* Motsch. (Prioninae); 2—*Distenia gracilis* Bless. (Disteniinae); 3—*Anoplodera robra* (L.) (Lepturinae); 4—*Necydalis major* L. (Necydalinae); 5—*Asemum striatum* (L.) (Aseminae); 6—*Xylotrechus altaicus* (Geb.) (Cerambycinae); 7—*Eodorcadion quinquevittatum* Hamm. (Lamiinae).

separated or contiguous in Lepturini; long, spinescent, widely separated and curved like tongs in Asemini and Spondyliini; long, coriaceous and bent posterolaterally in Necydalini; and represented by a large spine in many Lamiinae (Dorcadionini, Monochamini, and others) (Figure 6).

TAXONOMY

KEY TO SUBFAMILIES OF THE FAMILY CERAMBYCIDAE

Adult Insects

- 45 1 (2). Prothorax laterally with sharply crenate or spinous margin. . .
..... I. **Prioninae**.
- 2 (1). Prothorax laterally without sharp margin, uniformly rounded,
or tubercularly, sometimes conically produced (some Steno-
corini, Monochamini).
- 3 (4). First antennal segment very thick, 3.0 to 4.0 times thicker
than 3rd; remaining segments slender, almost filiform.
..... II. **Disteniinae**.
- 4 (3). First antennal segment not very thick, not more than 2.0
times thickness of 3rd.
- 5 (10). Head set forward, inclined downward at an obtuse angle to
body axis, frons not vertical, tapers negligibly. Palps obtuse
or truncate at apex.
- 6 (7). Cervix distinct behind eyes; temples project markedly, pro-
duced or taper abruptly. III. **Lepturinae**.
- 7 (6). Cervix almost imperceptible behind eyes, head here with
parallel sides or narrows slightly backward; temples poorly
demarcated from cervix.
- 8 (9). Antennae set anterior to eyes, near mandibular base.
..... IV. **Aseminae**.
- 9 (8). Antennae set between eyes, removed from mandibular base. . .
..... V. **Cerambycinae**.
- 10 (5). Head set downward at a right angle to body axis, frons
vertical. Palps pointed at apex. VI. **Lamiinae**.

Larvae

- 1 (2). Anterior lower margin of epistoma (frons) projects, with
well-developed denticles. I. **Prioninae**.
- 2 (1). Anterior lower margin of epistoma (frons) even, without
perceptible denticles.
- 3 (4). Hypostoma lacking; maxillae and labium attached directly
to prothorax. II. **Disteniinae**.

- 4 (3). Hypostoma well developed; maxillae and labium attached to anterior margin of cephalic capsule.
- 5 (8). Mandibles obliquely truncate apically, with highly projecting lower and well-developed upper dorsal denticle.
- 6 (7). Abdominal tergite IX with single spinule at apex or without spinules. III. **Lepturinae.**
- 7 (6). Abdominal tergite IX with two spinules at apex arranged transversely. IV. **Aseminae.**
- 8 (5). Mandibles rounded apically (horseshoe shaped) or obliquely truncate, but do not project.
- 9 (10). Clypeus and labrum small, mask only the joint of mandibles. Hypostoma divided by gula into two triangular sclerites. Apex of mandibles rounded, horseshoe shaped. . . V. **Cerambycinae.**
- 46 10 (9). Clypeus and labrum large, mask much of mandibles. Hypostoma entire, not divided into two triangular sclerites. Apex of mandibles obliquely truncate, not horseshoe shaped. VI. **Lamilinae.**

Pupae

- 1 (2). Pronotum not rounded laterally, with sharp, sometimes flattened margin. I. **Prioninae.**
- 2 (1). Pronotum rounded laterally or with produced conical tubercle.
- 3 (4). First antennal segment 2.0 to 3.0 times thicker than the rest. Antennae long, form common ring ventrally. II. **Disteniinae.**
- 4 (3). First antennal segment not more than 1.5 times thicker than the rest. Antennae short or long; if long, recurved independently in form of loop (Callichromini and others), ring or spiral (Monochamini and others).
- 5 (6). Pronotum anteriorly with distinct transverse flange. If without perceptible flange, then with pair of urogomphi directed backward or upward on tip of abdomen. . . . III. **Lepturinae.**
- 6 (5). Pronotum anteriorly without transverse flange.
- 7 (8). Antennae laterally with spinules; if without spinules (genus *Magasemum*), tip of abdomen with pair of urogomphi recurved inward like tongs. IV. **Aseminae.**
- 8 (7). Antennae laterally without spinules; tip of abdomen without urogomphi or with single spinescent process.
- 9 (10). Hind femora glabrous at apex, with neither setae nor spinules. Tip of abdomen without spinescent urogomphi. V. **Cerambycinae.**

- 10 (9). Hind femora usually with spinules or setae at apex; if without them (Dorcadionini), tip of abdomen with spinescent urogomphi. VI. **Lamiinae.**

I. Subfamily Prioninae

The subfamily Prioninae is one of the oldest and comprises smaller groups of the family Cerambycidae. In USSR fauna (excluding the tribe Parandrini) it includes 21 species, four of which inhabit northern Asia and belong to three genera and three tribes. It is thought that the species of Prioninae were abundant in northern Asia during the Tertiary period. Later, in the Glacial epoch the subfamily underwent considerable extinction. At present the maximum number of species of this subfamily has been recorded in regions of southern Asia where the climate is warm.

KEY TO TRIBES

Adult Insects

- 1 (4). Pronotum at anterior and posterior angles with projecting sharp spine that is sometimes replicated.
- 2 (3). Pronotum along lateral margins with innumerable acicular spines, large at anterior and posterior angles, and smaller between (medial). 1. **Callipogonini.**
- 47 3 (2). Pronotum along lateral margins with three spines, medial one projects more and larger. 2. **Prionini.**
- 4 (1). Pronotum gently rounded at anterior and posterior angles, without spines: laterally with single sharp acicular spine medially. 3. **Tragosomini.**

Larvae

- 1 (4). Epistoma on upper anterior margin medially even, without denticles; laterally near anterior angles without deep notch.
- 2 (3). Epistoma on upper anterior margin laterally above mandibular base with three broad triangular denticles. Found on thick trunks of decaying and dead elm, maple, and other deciduous tree species. 1. **Callipogonini.**
- 3 (2). Epistoma on upper anterior margin laterally above mandibular base at most with single denticle. Found on roots of old dead maple and other deciduous tree species. 2. **Prionini.**
- 4 (1). Epistoma on upper anterior margin medially with projecting

riblike denticles; laterally near anterior angles with deep sharp notch. Found on thick trunks of fallen pine and maple trees. . .
 3. **Tragosomini.**

Pupae

- 1 (4). Abdominal tip (dorsal view) without widely separated spinules, at most with pair of contiguous tubercles directed backward.
- 2 (3). Body very large. Abdominal tergites on posterior margin with pair of paramedial yellow crescentoid marks. Abdominal tip without tubercles. 1. **Callipogonini.**
- 3 (2). Body less large. Abdominal tergites on posterior margin without paramedial yellow crescentoid marks. Abdominal tip with pair of obtuse contiguous tubercles. 2. **Prionini.**
- 4 (1). Abdominal tip with two widely separated spinules directed upward. 3. **Tragosomini.**

1. Tribe CALLIPOGONINI

More abundantly represented in regions with a warm tropical climate. Only one species of relict origin preserved in broad-leaved forests of Ussuri-Primor'e region.

1. Genus *Callipogon* Serv.

Serville, 1832, *Ann. Soc. Entom. France*, vol. 1, p. 140; Gressit, 1951. *Longicorn Beetles of China*, vol. 2, p. 17; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 65-66.

Adult: Characterized by large body, presence of innumerable spinules on sides of pronotum, and other features.

Larva: Body thick, resilient; upper anterior margin of epistoma laterally with three broad denticles.

Pupa: Body massive; abdominal tergites laterally, away from midline, with crescentoid yellow spots.

The genus *Callipogon* is represented in USSR fauna by a single species, which inhabits broad-leaved forests in Ussuri-Primor'e region. A.P. Semenov-Tyan-Shanskii treated *Eoxenus* as an independent subgenus, which is essentially a relict of primitive fauna that flourished in the Tertiary period.

Type species: *Prionus barbatus* Fabricius, 1781.

48 1. *Callipogon relictus* Sem.

Semenov. 1898, *Hor. Soc. Entom. Ross.*, vol. 32, p. 563; Il'in, 1926,

Rus. Entomol. Obozr., 20, 3-4, 204-209; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 66-68; Lyubarskii, 1953, *Entomol. Obozr.*, vol. 33, pp. 95-102.

Adult (Figure 7): Body large, elongate. Head set forward. Eyes broadly emarginate, small, and sharply faceted. Antennae of male extend far beyond middle of elytra; of female, barely reach this level. Mandibles of male massive, long, crenate along inner side, bifurcate (biapical)

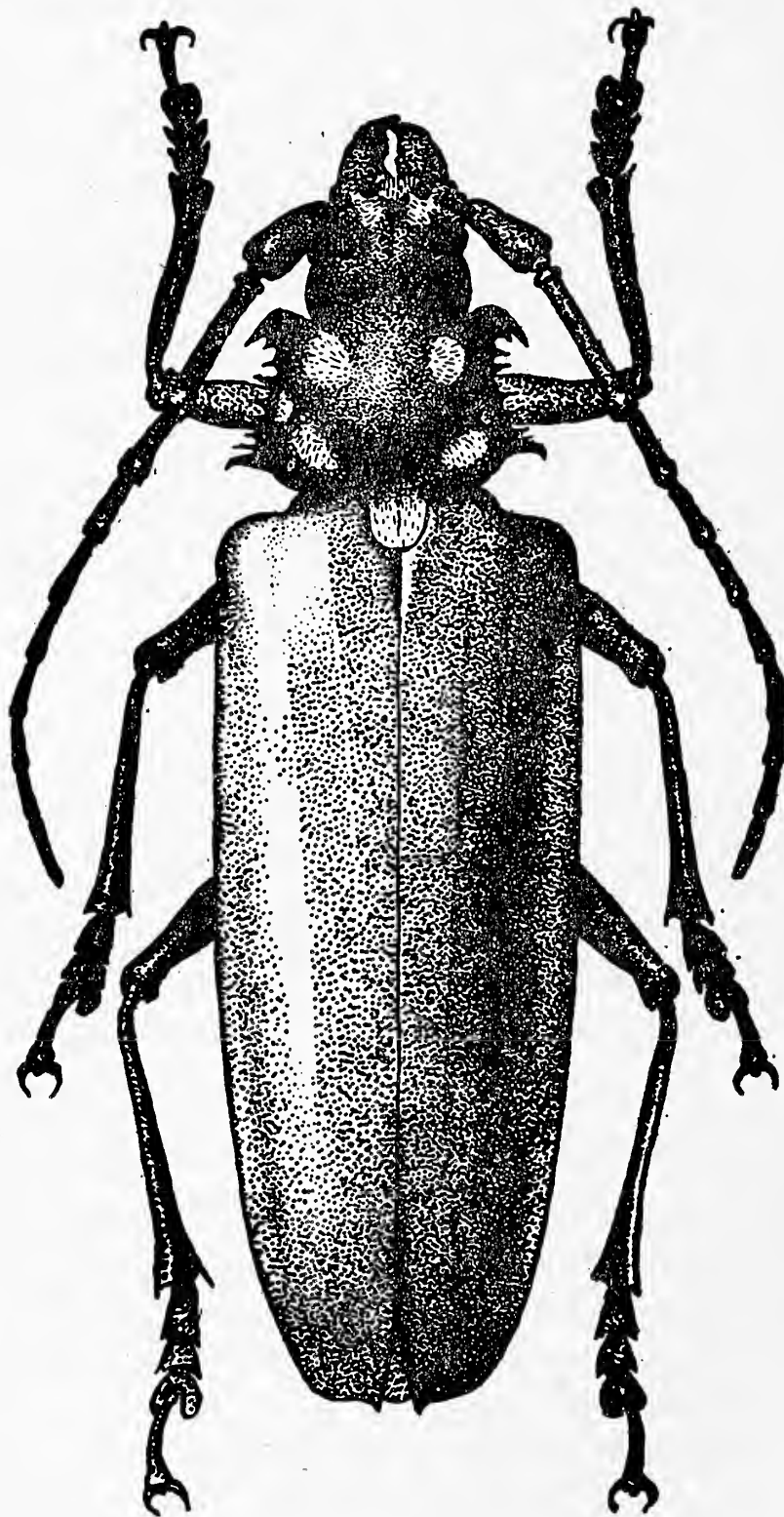


Figure 7. *Callipogon relictus* Sem.

at apex, dorsomedially with long thick upturned tooth removed from lateral margin; of female small, not bifurcate at apex but pointed. Pronotum transverse, convex, matte, with dense minute punctation, laterally with sharp spinules, angles produced, spinescent (in female spine of anterior angles longer, sharp, and recurved), with two pairs of pubescent spots. Scutellum broadly rounded apically, with dense tomentose grayish hairs.

Elytra long, with parallel sides, convex, with minute indistinct punctation, and apex of inner angles produced, spinescent. Metathorax laterally, abdominal sternite I entirely, and rest of sternites laterally with dense grayish-brown hairs. Body black or lustrous black. Elytra brownish-chestnut. Legs black, sometimes with chestnut tone. Body length of female 58 to 85 mm, of male 60 to 108 mm.

Egg: Elongate-oval, narrows toward both ends and blunt, collar-like at poles; initially pinkish, then darkens, turning black. Chorion with dense deep, slightly faceted cells. Spaces between cells produced at angles, spinescent, comparatively thick, but markedly smaller than cells per se. Length 6.0 to 7.0 mm, width 2.5 mm.

Larva (Figure 8): Body massive, more or less resilient. Head markedly retracted into prothorax. Epistoma distinctly demarcated. Frontal sutures and longitudinal suture distinct. Hypostoma consists of two triangular sclerites widely separated by advancing gula. Clypeus small, transverse, whitish. Labrum convex, broadly rounded on anterior margin, with short rusty setae, brown basally. Mandibles massive, gently truncate at apex, and pointed at end.

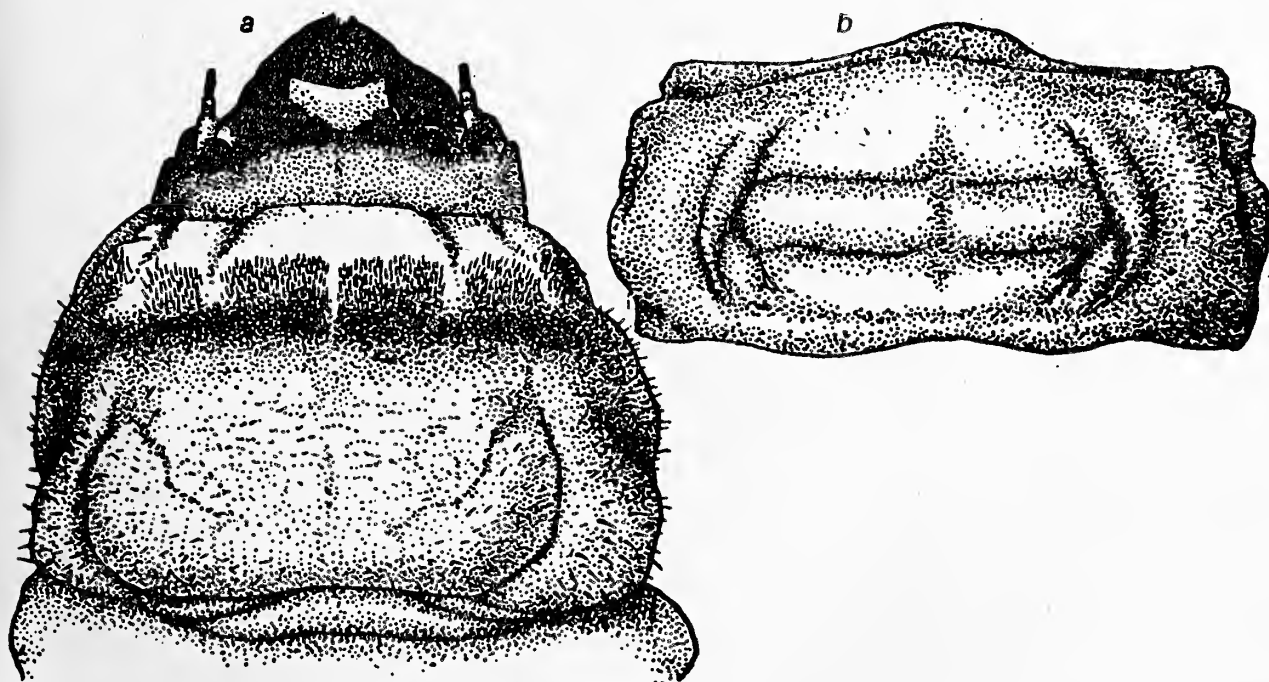


Figure 8. Larva of *Callipogon relictus* Sem.

a—head and pronotum; b—abdominal tergite with locomotory ampulla.

Pronotum slopes markedly toward head, broadens toward base; short setaceous hairs form transverse stripe in anterior half. Pronotal shield transverse, slightly convex basally, laterally bound by small longitudinal fold, with deep distinct, sometimes longitudinally rugose punctation. Thoracic legs short, small, with long claws, and thick spinescent setae.

Abdomen elongate, narrowly rounded terminally, and with very sparse setaceous hairs. Dorsal locomotory ampullae protuberant, divided by longitudinal groove and two transverse grooves that join laterally with longitudinal, angularly curved folds. Body white. Mandibles black. Anterior half of pronotum with transverse rusty plate on which (sometimes) four narrow notches occur along anterior margin. Prosternum with four rusty transverse spots with inner posterior angles sharply produced. Body length 100 to 150 mm, width of head 10 to 16 mm,

Pupa (Figure 9): Body large and stocky. Head slightly bent under. Antennae flexed to sides, with apices bent ventrad. Frons between antennae slightly impressed. Pronotum transverse, laterally flattened, with narrow median longitudinal groove. Mesonotum with slightly perceptible median longitudinal groove and transverse striation. Metanotum on disk with dense transverse sinuous striation and two sharp, somewhat divergent carinae.

Abdomen broad, distinctly narrows at tip. Abdominal tergites protuberant, with short, comparatively thick spinules, and on posterior margin laterally, away from midline, with yellowish crescentoid spots. Abdominal tip obtuse, bordered by triangular carina. Valvifers of female hemispherical, contiguous. Body length 70 to 110 mm, width of abdomen 24 to 30 mm.

Material: Collected in Ussuri-Primor'e region (Komarovka and Artemovka Rivers). Adult insects 17, larvae nine, pupa one, larval and pupal exuviae nine.

Distribution: Ussuri-Primor'e region, commencing from Khabarov; northeast China, and Korea.

50 *Biology*: Inhabits broad-leaved forests. Ecologically associated with thick-trunked trees. Flight of beetles from first 10 days of July to mid-September. Beetles feed on sap from trunks of linden, elm, and other wood species. Under laboratory conditions they readily consumed sugar syrup. One female consumed over 0.5 g syrup in one feeding. After mating female lays eggs on trunks of trees 30 to 100 cm or more in diameter, attaching them somewhat at an angle to the bark surface. Colonizes almost entire thick section of trunk. Found more often on valley elm (*Ulmus propinqua*), Amur linden (*Tilia amurensis*), Japanese poplar (*Populus maximowiczii*), Manchurian ash (*Fraxinus mandschurica*)
51 rarely on Manchurian maple (*Acer mandschuricum*), Mongolian oak

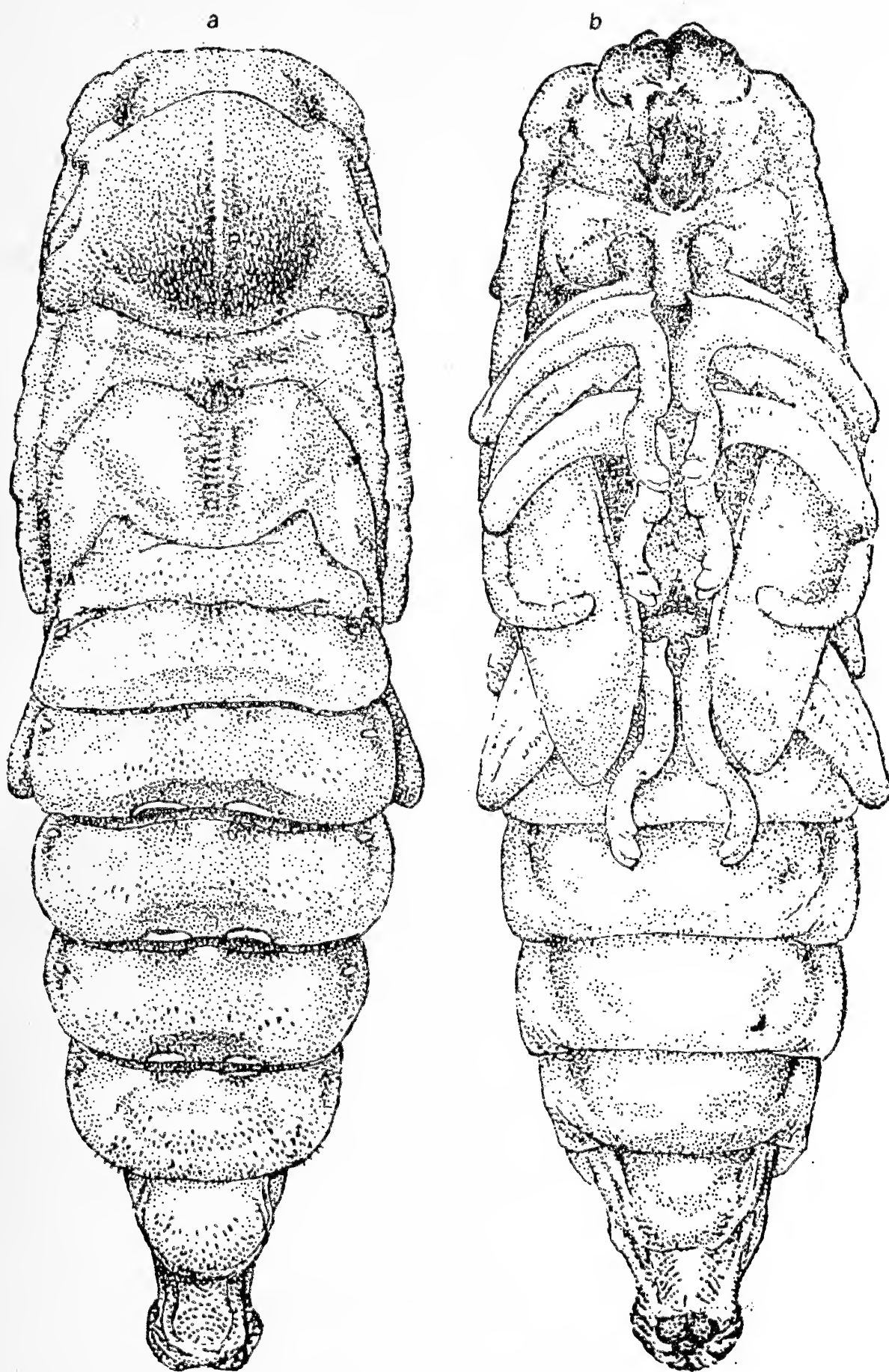


Figure 9. Pupa of *Callipogon relictus* Sem.
a—dorsal view; b—ventral view.

(*Quercus mongolica*), and also evidently on yellow birch (*Betula costata*). One female can lay up to 20 eggs. Weight of eggs varies from 15.8 to 18.8 mg. Sometimes eggs are laid in heaps on tree trunks and the same trees may be colonized in different years. Thus the larvae of different generations are often found together.

On hatching larvae bore under bark, make transverse galleries up to 40 cm long and 2.0 cm wide, then penetrate deep into wood, leaving on the surface an elongate opening (0.8 cm \times 2.0 cm to 1.4 cm \times 4.0 cm) longitudinal to trunk. Inside wood at a depth of 5.0 to 30.0 cm they make longitudinal, transverse, or meandering galleries, which sometimes intersect or merge and are densely plugged with frass. Width [sic] of gallery in wood ranges from 2.8 to 11.0 cm and diameter 2.0 to 2.5 cm. Larvae hibernate no less than five times. After fifth hibernation they make spacious pupal cells in wood across trunk at a depth up to 20 cm (length of pupal cell 15 to 18 cm, width 6.0 to 7.0 cm; layer of wood left between cell and trunk surface about 2.0 to 3.0 cm or more). Subsequently the larva rotates in its pupal cell so that its head faces the trunk surface and pupates sometime later. Prepupal period lasts for 20 to 22 days.

Pupation occurs in June and July. Pupae develop in nature in four to five weeks and young beetles appear in July and August. They bite oval openings (2.5 cm \times 3.5 cm to 3.0 cm \times 4.5 cm) on the trunk surface. Weight reduction during metamorphosis is significant. Thus, for example, weight of larvae before pupation (two females) 21.5 and 26.2 g, pupae 19.5 and 23.2 g, and adult insects 13.3 and 14.9 g (weight reduction 38.2% and 53.0% respectively); in another individual (one male) corresponding weights were 24.4 g, 22.0 g, and 20.7 g, i.e., weight reduction during metamorphosis from larva to adult was 15.2%.

Larvae carry fungal spores into the wood (*Pleurotus citrinopileatus*), which later cause rot (Lyubarskii, 1953). The wood consequently disintegrates and the trunk often snaps and falls with the larvae still inside it. This species is often found together with *Leptura thoracica* Creutz., *Rhaphuma acutivittis* (Kr.) (on maple), *Rosalia coelestis* Sem. (on maple), *Anoplodera cyanea* (Gehl.), and other species of the family Cerambycidae.

2. Tribe PRIONINI

Comparatively small. In Siberian fauna this tribe is represented by only one genus, *Prionus*, which includes a large number of species inhabiting the USSR, mostly the central Asian region.

1. Genus *Prionus* F.

Fabricius, 1775, *Syst. Entom.*, p. 159; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 69–71; Gressit, 1951, *Longicorn Beetles of China*, vol. 2, p. 24.

Adult: Usually with three spines on each side of pronotum.

Larva: Only one denticle on each side of upper anterior margin of epistoma.

Pupa: Pair of contiguous tubercles on tip of abdomen; bright crescentoid spots lacking on posterior margin of abdominal tergites.

The USSR fauna contains no less than 15 species of this genus. Of them, only two species inhabit northern Asia, including one entering from Europe into western Siberia, while one is found east of Baikal in the southern region.

Type species: *Cerambyx coriarius* Linnaeus, 1758.

52

KEY TO SPECIES

Adult Insects

- 1 (2). Pronotum lustrous, with minute punctation. Hind tibiae on upper side with longitudinal groove. 1. *P. insularis* Motsch.
- 2 (1). Pronotum matte, with dense coarse rugose punctation. Hind tibiae on upper side rib shaped, without longitudinal groove. 2. *P. coriarius* (L.)

Larvae

- 1 (2). Upper anterior margin of epistoma acute, even, and markedly produced forward. 1. *P. insularis* Motsch.
- 2 (1). Upper anterior margin of epistoma uneven, barely produced forward medially, slopes laterally. 2. *P. coriarius* (L.).

1. *Prionus insularis* Motsch.

Motschulsky, 1857, *Etudes Entom.*, vol. 6, p. 36; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 74–75; Gressit, 1951, *Longicorn Beetles of China*, vol. 2, pp. 24–25; Kojima and Hayashi, 1969, *Insect Life in Japan*, vol. 1, p. 5.

Adult (Figure 10): Body broad, nearly oval. Head set forward, considerably narrower than pronotum, with prominent deep punctation, and deep longitudinal suture on frons. Eyes large, sharply faceted, transversely elongate, and anteriorly emarginate. Antennae basally flexed to mandibles, with 12 segments; in male thicker, with apices reaching far beyond middle of elytra, 3rd segment serrate; in female comparatively

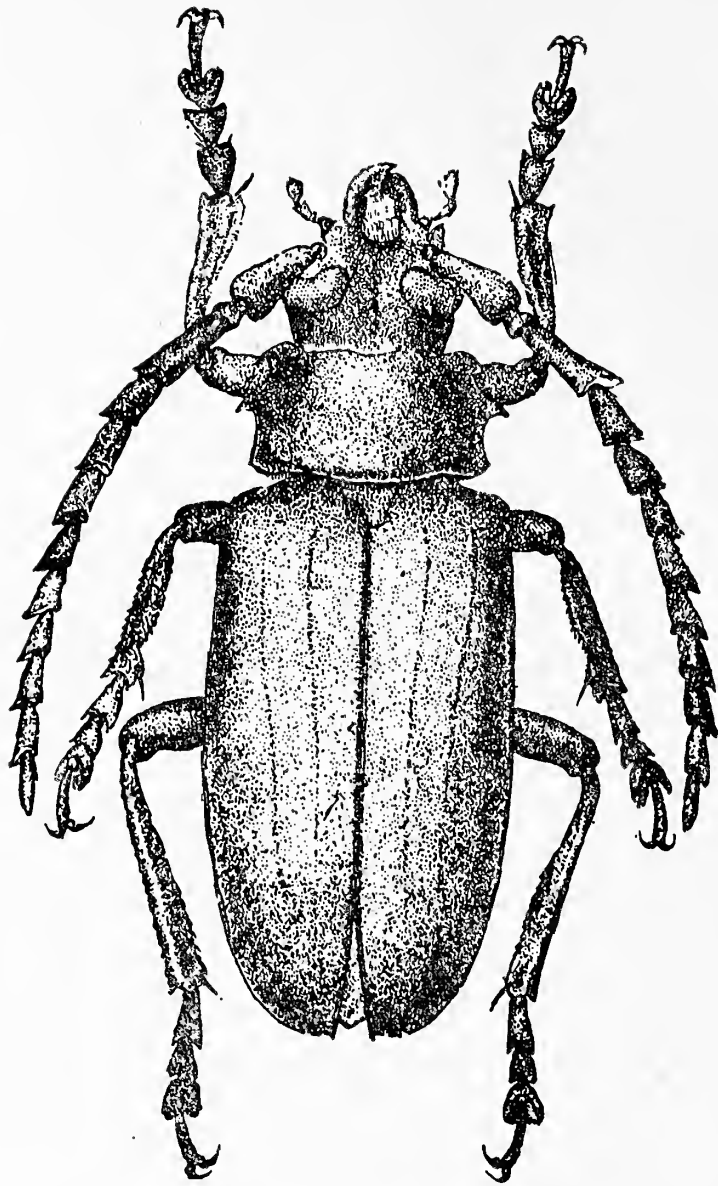


Figure 10. *Prionus insularis* Motsch.

slender, barely reach middle of elytra, with apices of 7th to 11th segments serrate and produced.

Pronotum bulges slightly, width almost 2.0 times length, flattened laterally, acutely produced, spinescent at angles and mediolaterally, with sparse punctation. Scutellum broad, glabrous, lustrous, with sparse very minute punctation, and gently rounded posteriorly. Elytra comparatively convex, smooth, glabrous, with dense indistinct punctation; apices of outer angles rounded and inner ones barely produced. Legs massive; foretibiae in front with deep longitudinal groove (distinct in male, faint in female), with sparse simple punctation (in female) or with distinct raised spinescent tubercles.

Abdominal sternite V in male apically emarginate and here with
 53 minute short hairs, in female less emarginate, smooth, with sharp margins, glabrous, and lustrous. Body lustrous black. Abdominal sternites and metathorax, sometimes femora and even elytra rusty-red. Length of body sometimes 23 to 48 mm, more often 29 to 35 mm.

Egg: Moderately elongate; at one pole somewhat obtuse, at the other narrowly rounded; white, later turning pinkish with brownish tone. Chorion with compact even deep cells. Spaces between cells slightly smaller than cells per se. Length 3.6 mm, width 1.3 mm.

Larva (Figure 11): Body thick. Head markedly retracted into prothorax. Epistoma flat, laterally bound by indistinct frontal sutures, medially divided by narrow brownish longitudinal suture; anterior margin near lateral angles narrowly emarginate and with produced sharp denticle near each; anterior section (frontal view) with deep transverse groove between emarginations so that upper anterior margin somewhat overhangs lower. Hypostoma divided into two triangular sclerites by broad gula; inner angles of these sclerites sharp. Clypeus short, broad, flattened, slightly trapezoidal, white. Labrum large, bulges basally, lustrous, reddish-rust, slopes apically, with coarse setae, and rounded anterior margin. Mandibles massive, apex obliquely truncate, inner edge

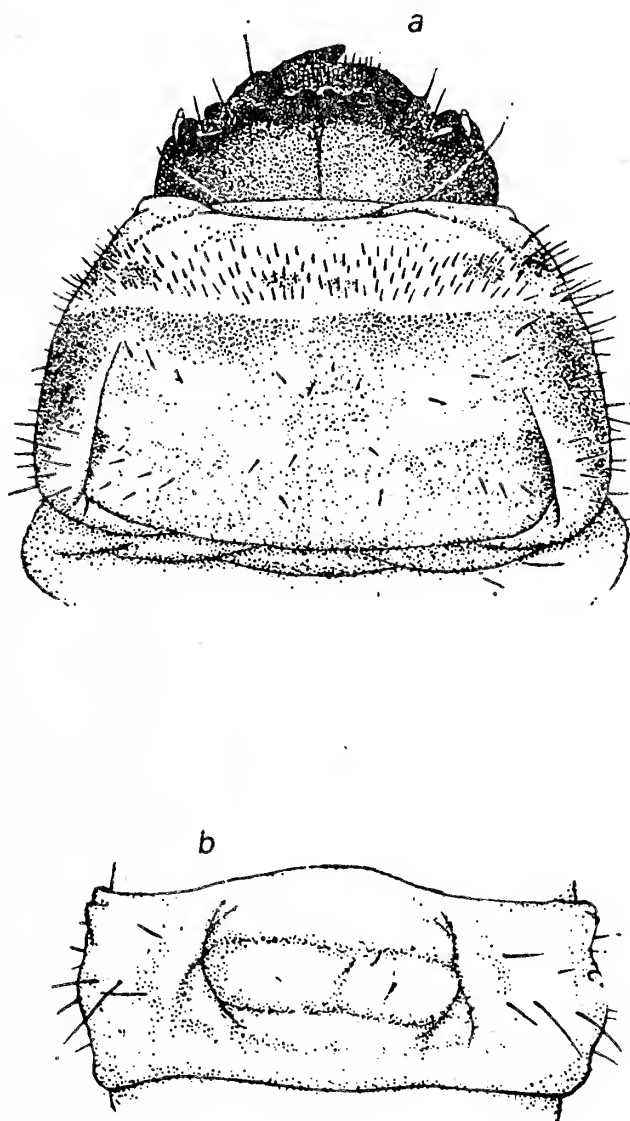


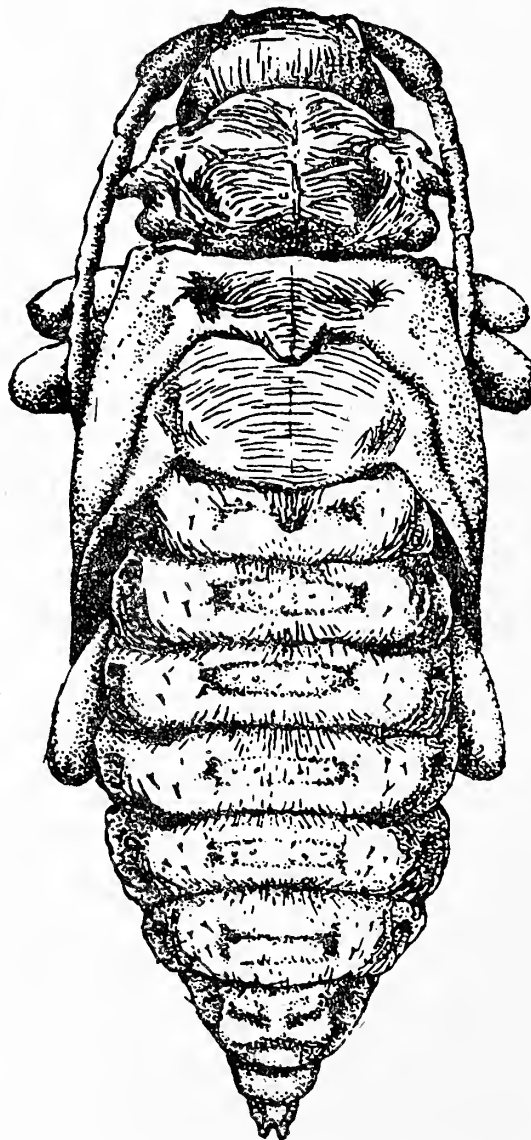
Figure 11. Larva of *Prionus insularis* Motsch.
a—head and pronotum; b—abdominal tergite with locomotory ampulla.

with transverse rib, outer side basally with uneven protuberance and apically with oblique transverse rib-shaped fold.

Pronotum transverse, anterior margin white with minute striation; 54 short setaceous hairs form transverse band along anterior margin, behind which small lustrous rust-colored transverse band occurs. Pronotal shield slightly convex, bound laterally by deep longitudinal fold that joins anteriorly with narrow groovelike dent extending inward, and with sparse short coarse setae. Thoracic legs short, with small claw.

Abdomen laterally with sparse thin hairs. Dorsal locomotory ampullae divided by two transverse grooves laterally joining longitudinal folds. Ventral locomotory ampullae similar to structure but lateral transverse grooves proximate and their common transverse groove joins longitudinal fold. Body white, anterior margin of head and mandibles black. Body length of III-instar larvae 40 to 55 mm, width of cephalic capsule 11 mm.

Pupa (Figure 12): Differs from pupae of other species in massive



thick body and characteristic transversely wrinkled sculpture of pro-, meso-, and metanota. Head short, moderately bent under. Antennae flexed to elytra. Pronotum uneven, tubercularly convex, markedly transverse, laterally with produced digitate spine directed backward; on disk with transverse coarse striation and median longitudinal groove. Meso- and metanota slightly convex, with deep parallel transverse striation. Abdomen thick; abdominal tergites convex, with sparse obtuse spinules (sometimes bearing setae). Abdominal tip with two short processes. Body length (male and female) 35 mm, width of abdomen 12 mm.

Material: Collected in Ussuri-Primor'e region (Komarovka River). Adult insects 10, larvae 12, pupae three, and 25 larvae raised from eggs.

Distribution: Ussuri-Primor'e region from Khabarov to Pacific Ocean coast, southern Sakhalin, Kunashir; northeast China, Korea, and Japan.

Biology: Inhabits broad-leaved forests. Ecologically associated with decaying old woodstock of deciduous species. Habitat confined to valleys, moderately dense forests in catchment areas, and terraces with developed grass cover. Flight of beetles commences in July and continues into September. Beetles sighted in large numbers in August. Female lays eggs in soil to a depth of 3.0 to 5.0 cm on roots of thick-trunked decaying trees and stumps, usually in batches of five to eight at one site. Weight of eggs laid 3.0 mg. Female fecundity comparatively high. Ovaries of one female dissected July 29, two days after her emergence from pupal cell, contained 153 fully developed eggs. Larvae hatch from eggs in nature in four to five weeks after oviposition. Thus from eggs laid on July 28 and 29 larvae hatched by August 31. En masse hatching of larvae observed end of August and in September.

Young larvae have a somewhat flat body covered with sparse very long hairs. Their weight at this time usually does not exceed 2.5 to 2.8 mg. Young larvae bore into bark of thin roots, make longitudinal galleries underneath it toward base, and plug them with frass. They colonize roots inside the soil but not exposed roots. Later, II- and III-instar larvae gradually migrate from thin to very thick roots 2.0 to 10.0 cm in diameter, making long galleries there under bark and in wood, sometimes penetrating pith. They are generally found in dead, often rotten roots of decayed and decaying or viable trees. Width of gallery up to 25 mm. Third-instar larvae migrate to root surface, make pupal cell (cocoon) in soil alongside root with large fibrous frass. Interior of pupal cell consists of soil bed (polished by rotatory movement of larva) and exterior of soil clots. Pupal cell spherical and somewhat flat; length 38 to 65 mm, width 38 to 48 mm, height 30 to 35 mm, and thickness of wall 3.0 to 4.0 mm. Larva lies curved in pupal cell for quite sometime before pupating.

Pupation occurs in second half of June and in July. Thus on July 1st on a tree in the forest close to Komarovka River, two pupae and six larvae were found in cells on turf alongside the roots. Pupae developed in 20 to 28 days. Beetles sighted in second half of July. They emerge from cells onto soil surface and immediately begin to reproduce. Weight of larvae before pupation varies from 5.0 to 5.4 g, of pupae 2.4 to 4.4 g, and of beetles after emergence from cocoon 1.2 to 2.9 g. One larva weighed 11.3 g. Generation completed in three years and larvae pupate after third hibernation.

Colonizes roots of old dead thick-trunked trees of oak, maple, elm, and possibly other species; often colonizes roots of stumps. Larvae of *Stenocorus amurensis* (Kr.) also occur together with this species on roots.

2. *Prionus coriarius* (L.)

Linnaeus, 1758, *Syst. Nat.*, 10th ed., p. 389 (*Cerambyx*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 76-78; Greze, 1936, *Zakhist lisu*, vol. 14, p. 107; Demelt, 1966, *Die Tierwelt Deutsch.*, 52, II. *Bockkäfer oder Cerambycidae*, pp. 28-29; Duffy, 1953, *Monograph Immat. Stages of British and Imp. Timb. Beetles*, pp. 106-112.

Adult (Figure 13): Very close to *Prionus insularis* Motsch. Differs in dense coarse, sometimes fused punctation on pronotum, rounded inner angles not produced into spinules on elytral apices, and other features. Head between eyes and behind them with coarse uneven punctation. Antennae of male with serrate 3rd segment, apices barely reach beyond middle of elytra, with 12 segments; of female, with slightly serrate 4th segment, apices not reaching middle of elytra, and usually with 11, rarely 12 segments.

Pronotum transversely convex, laterally with three produced sharp spinous processes (of which, middle one more elongate and slightly produced backward), with dense coarse, at places fused uneven punctation. Scutellum smooth, glabrous, rarely with punctation, slightly elongate, and narrowly or broadly rounded apically.

Elytra broad, moderately convex, matte, with dense, very minute rugose punctation, at apex on outer side gently rounded, on inner side abruptly rounded; inner angle without spinule. Foretibiae with or without faint longitudinal groove. Body brownish-black, with rusty or reddish tone. Abdominal sternites and legs, sometimes antennae, more reddish or rusty. Body length 28 to 45 mm.

Egg: White, with greenish tinge, at one pole broadly, at the other narrowly rounded. Chorion with dense deep punctation; distance between punctures less than size of them per se. Length 4.0 mm, width 1.5 mm.

Larva: Very similar to larva of *P. insularis* Motsch. Differs in more indistinct formations on outer side of mandibles and in some features of epistoma and pronotum. Body thick, not flat. Half or more of head retracted into prothorax. Epistoma slightly convex, with well-developed frontal and longitudinal (median) sutures, and barely produced upper margin in anterior section (in *P. insularis* Motsch. it distinctly overhangs lower margin). Hypostoma divided into two triangular, widely separated sclerites, narrowly rounded toward base. Mandibles on outer side smoothed more, basally with negligible tubercle, and apically with slight transverse rib-shaped fold and truncate.

Pronotum slopes slightly toward head; near anterior margin short setaceous hairs form transverse stripe, behind which smooth, glabrous, lustrous, rust-colored band occurs. Pronotal shield basally somewhat convex, coarsely rugose, laterally bound by longitudinal folds, and with

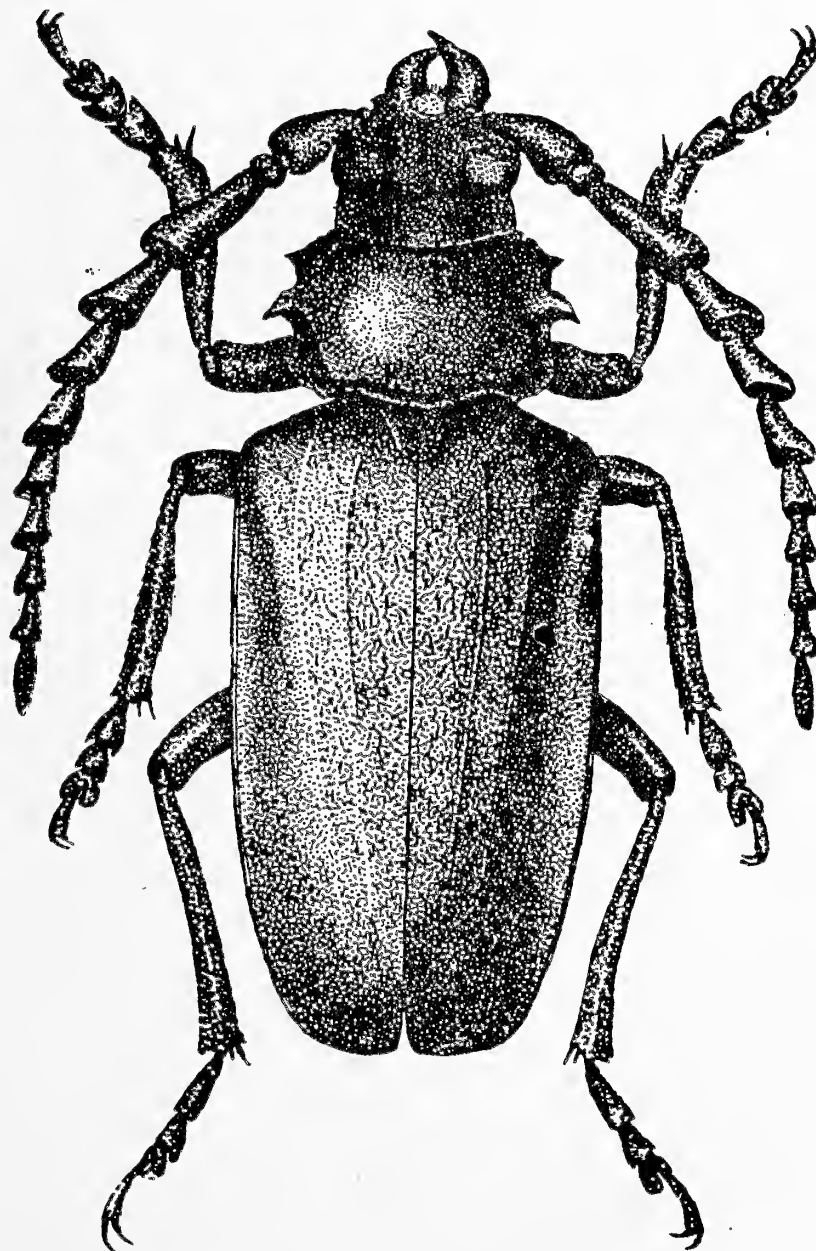


Figure 13. *Prionus coriarius* (L.)

slight dents at anterior angles. Thoracic legs short, with small claw, inner side with short setae. Locomotory ampullae on abdominal segments I to VII coriaceous. Dorsal locomotory ampullae convex, divided by common median longitudinal groove and two transverse grooves that laterally join oblique folds. Ventral locomotory ampullae divided by two transverse grooves joined laterally by unpaired very short groove to lateral longitudinal folds; posterior groove medially interrupted. Body white. Anterior margin of head reddish-brown, mandibles black, transverse band in anterior half of pronotum and sides of pronotum yellowish-rust. Body length of III-instar larvae 50 to 90 mm, width of head up to 8.0 mm.

Pupa: Body massive and glabrous, without setae or spinules. Tip of abdomen pointed and dorsally with pair of rounded tubercles. Judging from exuviae taken from cell with beetle, pupa of this species very similar to that of *P. insularis* Motsch.

Material: Collected in the southern Urals. Adult insects seven, larvae eight, exuviae of pupa and larva from cells with beetles one each.

Distribution: West from Atlantic Ocean coast, east almost up to Yenisey; north from England, Sweden, Finland, Upper Volga, south to Spain, Algiers, and Greece. In western Siberia apparently rare; I did not find it there. Common in the southern Urals. In the Far East replaced by the allied species, *P. insularis* Motsch.

Biology: I collected four beetles from maple, two from oak, and one from elm. Found in coniferous and deciduous vegetation (Plavil'shchikov, 1936; Demelt, 1966). I studied the biology in broad-leaved forests in the southern Urals. Flight of beetles commences in last 10 days of July. Beetles emerge with developed gonads. Ovaries of one female emerging from soil on July 23 contained 38 mature eggs; those
57 of another female taken from pupal cell on July 24 contained 32. Weight of one egg about 2.0 mg. Female lays eggs in soil on dead roots and in basal zone of trunk of thick-trunked trees and stumps. Larvae live in underground zone of trunk and in roots, making longitudinal galleries and plugging them compactly with frass. Galleries initially made under bark, then in wood. I once found a gallery in the root of an oak in soil at a depth up to 30 cm, its length 172 cm, and width varying from 2.0 to 3.5 cm. First-, II-, and III-instar larvae were found in spring. One may conclude from this that the larvae hibernate not less than three times. Life cycle completed in three years.

Larvae of the last instar abandon galleries and make an oval, somewhat flattened pupal cell near the tree root in soil. Interior of pupal cell spread with dense compact wood shavings (frass) and exterior covered with soil particles. I once dug up a pupal cell containing a female beetle. Length of cell 7.0 cm, width 6.5 cm, height 4.0 cm.

Thickness of inner layer lined with wood shavings 4.0 to 7.0 mm and soil layer adhering exteriorly 7.0 to 8.0 mm. Beetles emerge from soil in second half of July and first few days of August. Weight of males emerging from soil 1,340 to 1,500 mg, of females 1,950 to 4,320 mg.

3. Tribe TRAGOSOMINI

In the fauna of northern Asia this tribe (= Anacolini) is represented by only one genus and a single species widely distributed in the Holarctic region.

1. Genus *Tragosoma* Serv.

Serville, 1832, *Ann. Soc. Entom. France*, vol. 1, p. 159; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 99; Linsley, 1962, *Cerambycidae of North America*, vol. 2, p. 54.

Adult: Body elongate. Pronotum transverse, with rounded anterior angles and acutely produced spinule laterally.

Larva: Characterized by distinct notch in anterior angles of epistoma.

Pupa: Tip of abdomen with two widely separated upturned spines.

One species of this genus inhabits Eurasia. Three species are known in North America including *Tragosoma depsarium* (L.)

Type species: *Cerambyx depsarium* Linnaeus, 1767.

1. *Tragosoma depsarium* (L.)

Linnaeus, 1767, *Syst. Nat.*, 12th ed., p. 624 (*Cerambyx*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 99-101; Kiseleva, 1926, *Izv. Tomsk. Un-ta*, vol. 2, p. 76; Demelt, 1966, *Die Tierwelt Deutsch.*, 52, II. *Bockkäfer oder Cerambycidae*, pp. 29-30.

Adult (Figure 14): Differs in elongate elytra, small pronotum, and brownish-rust coloration. Body elongate, negligibly convex. Head small, narrower than pronotum, with uneven punctation, and longitudinal narrow groove between eyes. Eyes bulge markedly, negligibly emarginate anteriorly. Antennae with 11 segments, thin, with apices reaching beyond middle of elytra (male) or not reaching this level (female).

Pronotum 2.0 times wider than long, mediolaterally with produced sharp spinule, more or less rounded at angles, with dense punctation, and dense rusty hairs (male) or almost glabrous (female); base with narrow elevated border. Scutellum triangular, with coarse punctation, sometimes with sparse adherent hairs, narrowly rounded apically.

Elytra markedly elongate, moderately convex, with parallel sides, dense rugulose punctation, and longitudinal ridges; apex rounded outwardly and inner angles produced, spinescent. Body ventrally with long

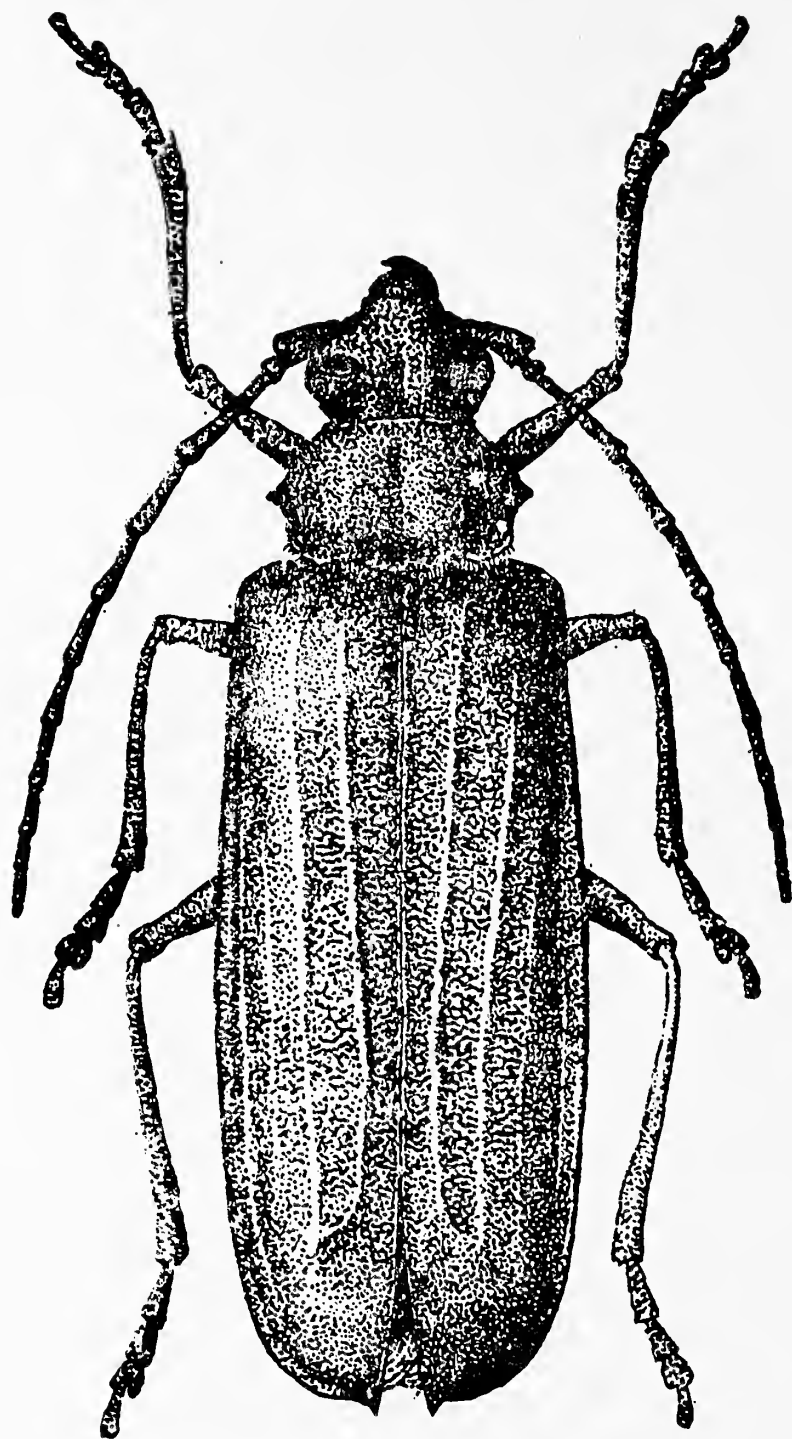


Figure 14. *Tragosoma depsarium* (L.).

golden hairs. Body brownish-rust. Legs and antennae lighter in color, reddish-rust. Body length 24 to 35 mm.

Larva (Figure 15): Well distinguished from those of the genus *Prionus* by structure of mandibles, presence of sharp fold on sides of epistoma, and other features. Body thick. Head markedly retracted into prothorax. Epistoma laterally on anterior margin with sloping notch, behind which arcuate sclerotized and crenate transverse fold extends from antenna to middle. Lower margin of epistoma with long, triangular, flat, pointed spine anterolaterally; upper margin medially somewhat elevated and distinctly overhangs lower margin, with small

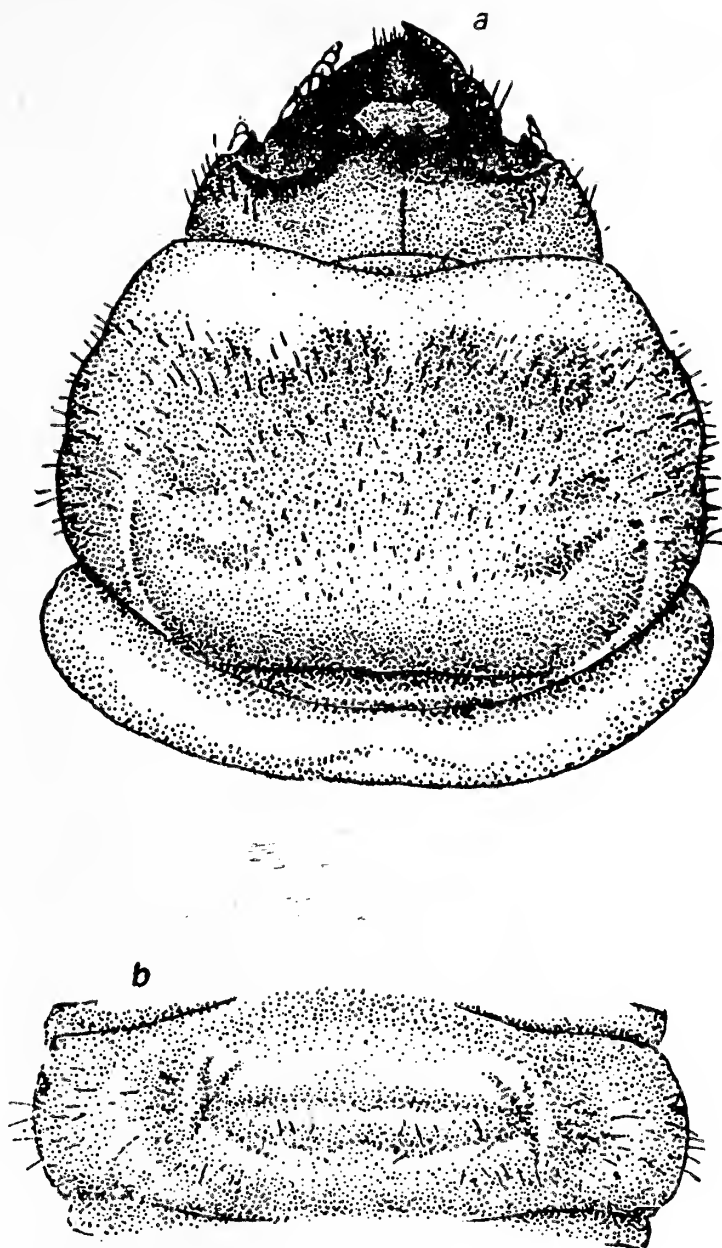


Figure 15. Larva of *Tragosoma depsarium* (L.).
a—head and pronotum; b—abdominal tergite
with locomotory ampulla.

rounded tubercular projections. Hypostoma consists of two smooth triangular sclerites separated by broad gula. Clypeus small, smooth, and whitish. Labrum convex, not smaller in length than width, rounded along anterior margin, with short rusty or golden setae. Outer side of mandibles basally convex, with coarse longitudinal striation, smooth toward apex, without transverse rib-shaped folds; inner side tapers gently, hollowed in truncate part apically.

Pronotum slopes forward; anterior margin with sparse short hairs that do not form continuous cover. Pronotal shield coriaceous, coarsely rugose, bound laterally by deep longitudinal folds joined in front of anterior angles by short, barely perceptible inner dents. Prosternum with sparse short setaceous hairs. Eusternum triangular, gently rounded apically. Thoracic legs slender, with pointed claw, and with small setaceous hairs.

Abdomen almost glabrous, with stray, barely visible light-colored hairs laterally. Dorsal locomotory ampullae convex, coriaceous, divided
59 by common longitudinal groove and two transverse grooves joined laterally by deep longitudinal folds. Ventral locomotory ampullae divided by single transverse groove joined laterally by longitudinal folds. Sometimes an additional posterior groove discernible, which is usually medially interrupted. Body white. Mandibles and anterior margin of head black. Length of body 40 to 45 mm, width of head 5.0 to 6.0 mm.

Pupa (Figure 16): Readily differentiated from pupae of the genus *Prionus* in four-cornered and blunt apex of abdomen, and presence of well-developed lateral spinules on abdominal segments. Head short, slightly bent down. Frons transversely convex, antennal bases very close to mandibles, flexed to margin of clypeus.

Pronotum transverse, laterally with produced tubercle, moderately

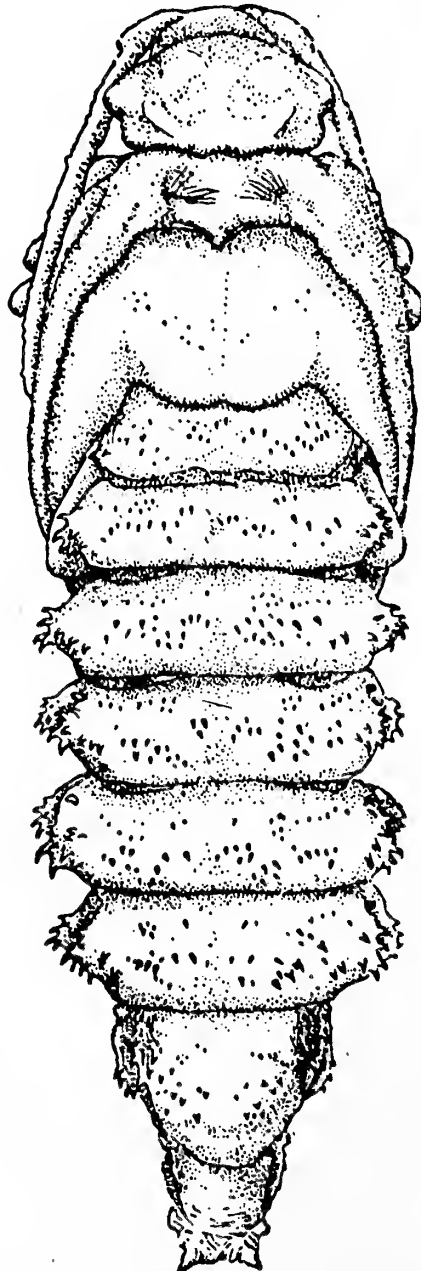


Figure 16. Pupa of *Tragosoma depsarium* (L.).

convex, anterior half of disk with stray minute, barely perceptible spinules, and barely visible, thin paramedial transverse striation. Metanotum smooth, lustrous, medially with longitudinal, somewhat diverging transversely, striate carinae, anteriorly with minute spinules forming oblique row that extends from midline of posterior half to anterior angles.

Abdomen elongate, tip obtuse with four angles and two widely separated spinules turned sideways. Abdominal tergites moderately convex, with sharp spinules medially. Dorsal and ventral sides of abdomen tubercularly convex, with large sharp spinules on these processes. Valvifers of female large and hemispherical, conical at tip (spinescent), just slightly produced laterally. Length of body 48 mm, width of abdomen 12 mm.

Material: Collected in Altai, in central Ob' region, and Yenisey taiga. Adult insects 28, larvae 117, pupae six.

Distribution: Eurasia and North America. Often found in Altai and the taiga of Tomsk district (Chulym River).

Biology: Ecologically associated with old woodstock. Habitats confined to coniferous forests. Extends in mountains up to 1,700 m above sea level. Flight of beetles commences end of June and continues into August. Colonizes mostly fallen dead cedar, pine, and other species. Large number of larvae found in wind-fallen decaying Siberian cedar (*Pinus sibirica*) in Altai at a height of 600 m above sea level. Larvae make longitudinal (sometimes meandering) galleries in upper layer of wood damaged by rot, and plug them with frass. Width of gallery made by III-instar larvae 1.5 to 2.0 cm. Pupal cell made at end of gallery 6.0 to 7.0 cm long and 2.0 to 2.3 cm wide. Pupation of larvae commences in June and is completed in first 10 days of July. Pupae seen in June and July. In 1975 in Altai large numbers of prepupae and pupae were found in last 10 days of June. Young beetles sighted end of June and in July. Weight of larvae before pupation ranges from 1,200 to 2,250 mg, pupae 1,000 to 1,750 mg, and beetles soon after emergence from cell 700 to 1,530 mg. Larvae hibernate no less than three times, pupate after third hibernation. Larvae of different generations often found on the same tree. *Anoplodera rubra* (L.), *A. virens* (L.), and *A. rufiventris* (Gebl.) were found together with this species.

II. Subfamily Disteniinae

The USSR fauna comprises only one tribe, which is rather distant in terms of evolution, and only one species inhabiting the forests of Ussuri-Primor'e region. Species of this subfamily are maximum in the fauna of southeast Asia and South America.

4. Tribe DISTENIINI

The USSR fauna comprises one species from one genus in this tribe. Numerous species are confined to southern Asia.

1. Genus *Distenia* Serv.

Serville, 1825, *Enc. Meth.*, vol. 5, p. 485; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 104-105.

Adult: Body slender, elongate. Antennae long and thin; 1st segment very thick. Forecoxae large and spherical.

Larva: Characterized by presence of locomotory ampullae only on first five abdominal segments. Hypostoma on lower side of head not developed; base of maxillae displaced backward to level of postero-lateral margin.

Pupa: Abdominal segments VII to VIII with long acute spinules recurved toward middle.

Type species: *Distenia columbina* Serville, 1825.

61 1. *Distenia gracilis* (Bless.)

Blessig, 1872-1873, *Hor. Soc. Entom. Ross.*, vol. 9, p. 168 (*Apheles*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 2, 105-106; Krivolutsкая, 1973, *Entomofauna Kuril'skikh ostrovov*, p. 99; Cherepanov and Cherepanova, 1975, *Zhuki-drovoseki ivovykh lesov Sibiri*, pp. 23-28.

Adult (Figure 17): Body elongate, slender. Head with dense sharp punctation, with mouth parts turned forward and somewhat downward. Frons between eyes with narrow interrupted longitudinal suture. Antennae long; 1st segment very thick, in male longitudinally compressed in front and with coarse rugose punctation, in female convex, with dense minute punctation; subsequent segments slender; in male 8th, in female 9th segment extends beyond tip of elytra; antennal segments apically with stray long hairs.

Pronotum broadens medially, with produced acute conical spines laterally, narrows sharply toward apex and base, near posterior and anterior margins with transverse grooved flange, and with dense minute punctation and gray closely adherent hairs. Scutellum not longer than width at base, apically rounded, with tender, sometimes dense hairs.

Elytra narrow, taper uniformly toward apex, length 2.5 to 3.5 times total width at humeri, and anterior half with deep punctation forming six distinct or somewhat indistinct longitudinal rows. Abdominal sternite V in female elongate, gently rounded posteriorly; in male distinctly emarginate, with minute tender closely adherent hairs. Legs long and slender; femora in male just slightly thicker than in female.

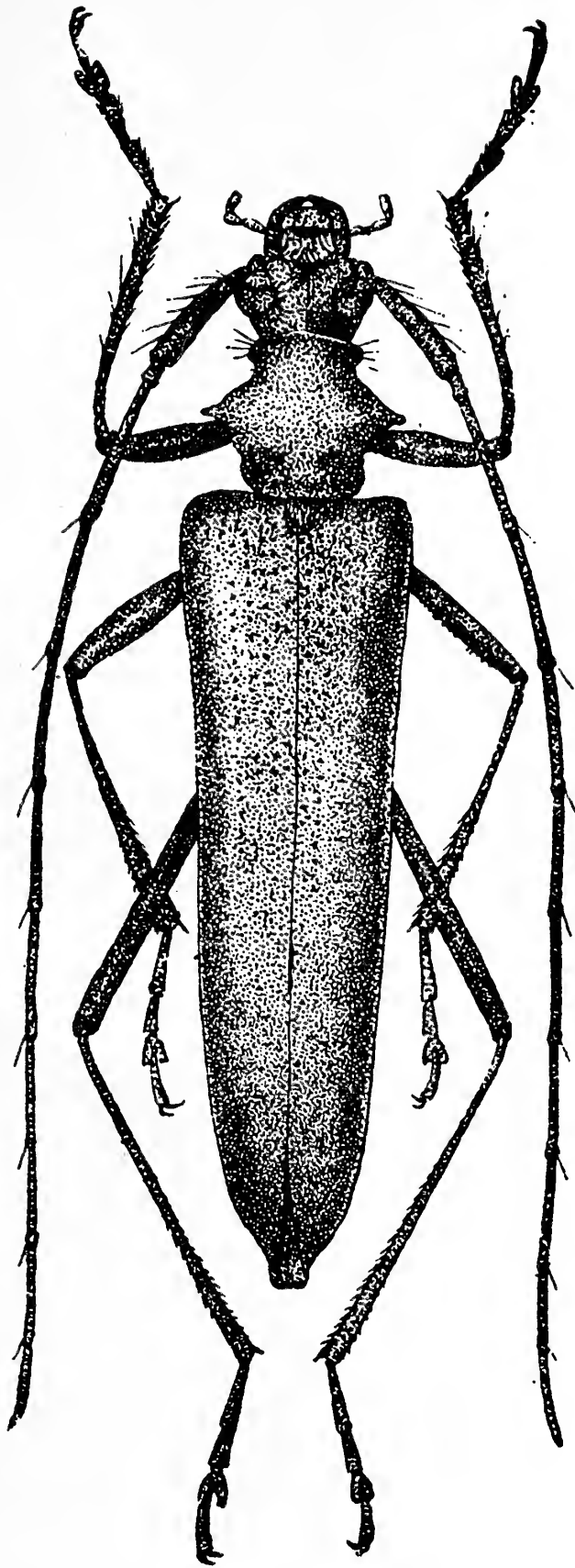


Figure 17. *Distenia gracilis* (Bless.).

Body uniformly lustrous brown with rusty tinge. Body length of male and female 24 to 28 mm.

Egg: White, thick, bulges in middle, and narrows markedly to almost pinched at poles; one pole with papilliform process; finely sculptured. Length 2.0 mm, width 0.8 mm.

Larva (Figure 18): Well distinguished by long slender body, absence of locomotory ampullae on abdominal segments VI to VII, and other features. Head transverse and flat. Epistoma almost not bound laterally (frontal sutures not visible), medially divided by longitudinal brownish stria (sutura medialis). Clypeus large, trapezoidal; labrum convex, transversely oval, with large punctation and short dense setae. Mandibles elongate, apically truncate, cultrate, with margins bent down and inward.

- 62 Pronotum transverse, length 0.50 width; anterior margin and sides with almost identical setaceous hairs. Pronotal shield shagreen-rust, notably sclerotized, with minute spinules, uneven ragged anterior margin, and laterally bound by more or less distinct folds. Thoracic legs short and poorly developed.

Abdomen elongate, slender. First five abdominal segments with convex and protuberant locomotory ampullae. Dorsal locomotory ampullae shagreen, divided by lateral longitudinal folds and oblique furrows that extend from anterior angles inward to posterior margin. Segment IX 2.0 times longer than wide and rounded posteriorly. Anal opening transverse, sometimes bent angularly midlength, and shifted ventrally. Body white, anterior margin of epistoma and mandibles dark brown. Body length before pupation up to 45 to 50 mm.

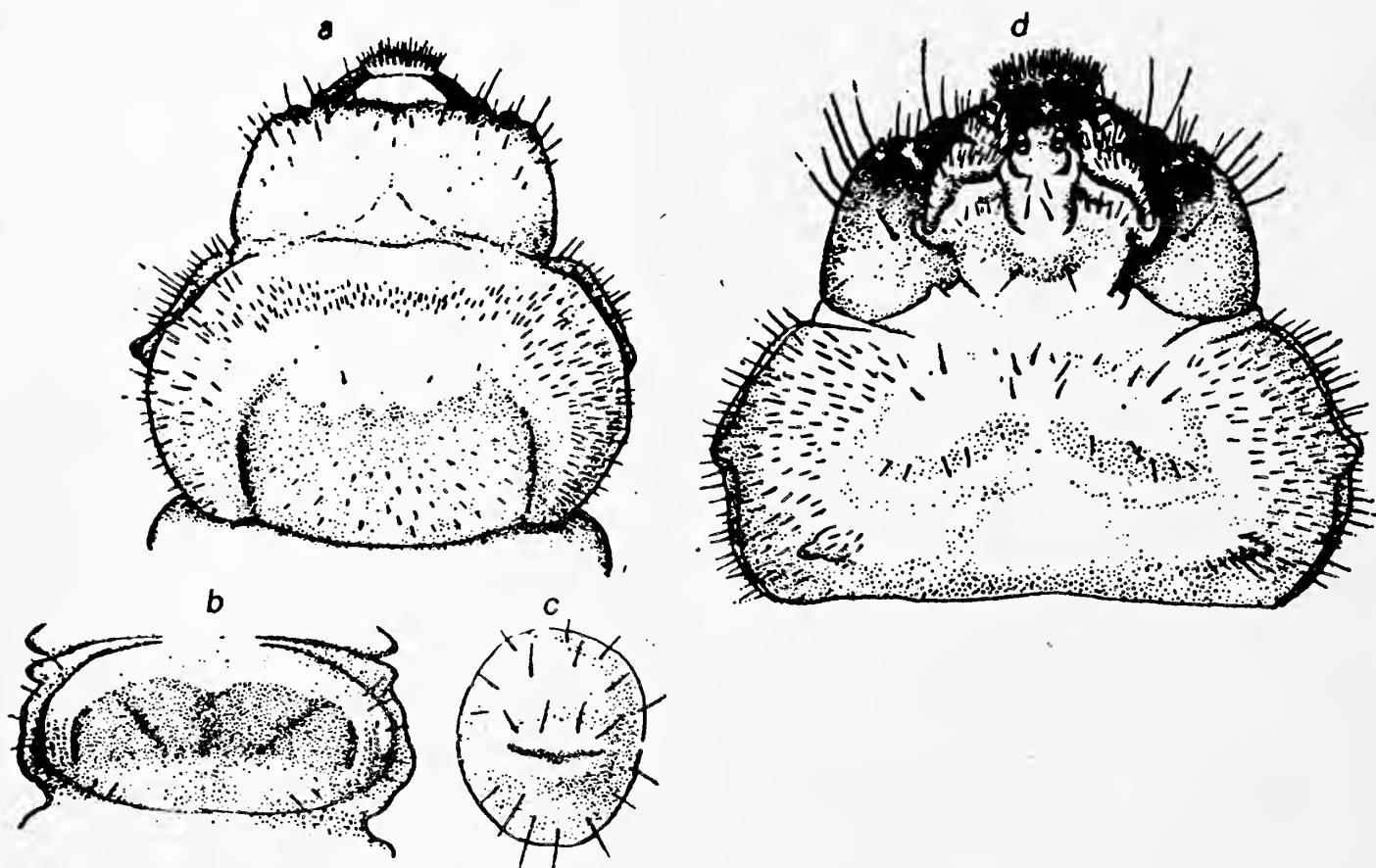


Figure 18. Larva of *Distenia gracilis* (Bless.).

a—head and pronotum; b—abdominal tergite with locomotory ampulla;
c—tip of abdomen; d—head and prosternum.

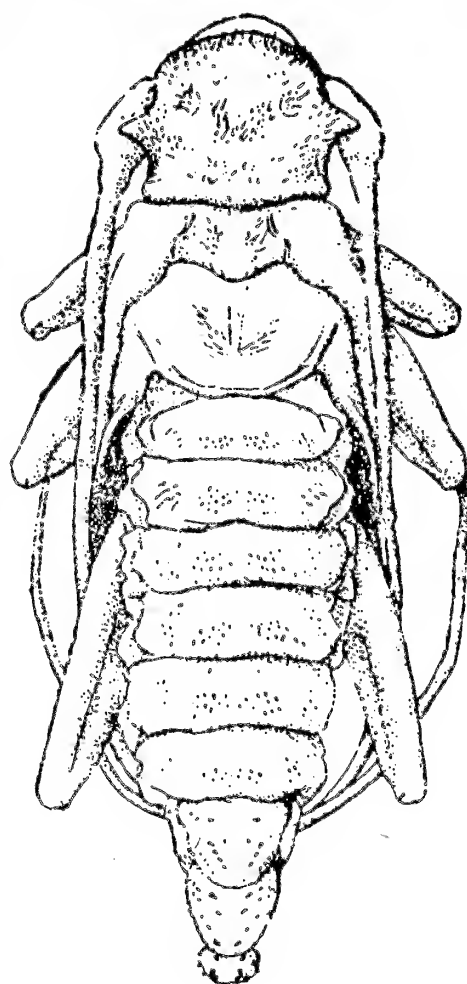


Figure 19. Pupa of *Distenia gracilis* (Bless.).

Pupa (Figure 19): Body comparatively flat, narrows from thorax to tip of abdomen. Head markedly bent under. Frons more or less flat; near base of antennae on inner side with setae forming one lateral tuft on each side. Postocular region with sparse piliform setae. Antennae long, form common ring, directed backward from base and flexed annularly on lower side at level of abdominal sternites III to IX, with apex terminating next to antenna on opposite side. Pronotum slightly
 63 convex, laterally with sharp extended spines; disk laterally and on anterior margin with setaceous tubercles.

Abdomen broadens in zone of segments IV and V and narrows toward tip. Abdominal tergites in posterior half and laterally in anterior half with numerous short but comparatively thick spinules directed backward. Tergite VIII with very large paired spinules bent toward middle. Of these, first and especially third pair widely separated, and second and fourth pair (posterior) closer to midline. Tergite IX with two longitudinal rows of large spinules along margin of flat glabrous area. Valvifers of female poorly developed, resemble small, barely separated processes. Length of body 25 to 28 mm, width of abdomen about 6.0 mm.

Material: Collected in Ussuri-Primor'e region, Sakhalin, and Kunashir. Adult insects 31, larvae 29, pupae eight, larval and pupal exuviae from cells with beetles 11.

Distribution: Ussuri-Primor'e region, Sakhalin, Kuril' Islands; Japan and Korea.

Biology: Inhabits willow and willow-alder stands. Beetles sighted in first half of July, lead a cryptic life, and usually not seen on flowers. Eggs laid on dead willow, alder, maple, and other species, usually around and on roots. Often inhabits stumps left from felled trees. In Kunashir found on a wind-fallen oak.

Larvae live in and under bark of roots, in underground zone of stumps and dead trees. They make longitudinal galleries under bark and in upper layer of root wood, filling them with frass. Toward the end of their development larvae are usually seen around basal zone of trunks. Here, in upper layer of wood, they make a pupal cell along trunk, turn their head upward, and pupate. Length of larval galleries 30 to 40 cm, width before pupal cell 10 to 12 mm. Length of pupal cell 25 to 45 mm, width 9.0 to 14.0 mm.

Pupation occurs end of June and in first half of July. Pupae develop for about three to four weeks. Young beetles sighted from middle 10 days of June. Seven days after formation they bite round holes 7.0 to 8.0 mm in diameter on trunk surface and emerge through them. Weight of pupa ranges from 198 to 469 mg, of beetle emerging from cell 159.5 to 296.6 mg. Life cycle completed in two years. The same trees (stumps) are very often inhabited continually over several years. Hence larvae of two generations are sometimes found together.

At some sites, however, development was markedly retarded. In 1974 in Kunashir beetle emergence from wood occurred almost two weeks later in Sernovodsk region than in Alekhino. This is explained by the much later onset of spring thaws in Sernovodsk.

III. Subfamily Lepturinae

This subfamily comprises a large number of species. Many tribes are common for the fauna of Eurasia and North America, some of them differing in taxonomic diversity of species. Most species are ecologically associated with dead wood (*Grammoptera*, *Cornumutula*, *Leptura*, *Anoplodera*, *Necydalis*, and others). Development of only some groups (*Brachyta*) is confined to herbaceous vegetation. Some members
64 (*Evodinus*) live on decaying or freshly fallen trees in the larval stage and enter the soil for pupation. All this indicates that the subfamily Lepturinae is very diversified in ecological characteristics, and that its evolution proceeded in conformity with its varying conditions of life.

KEY TO TRIBES

Adult Insects

- 1 (6). Elytra long, cover entire abdomen. Hind wings at rest concealed under elytra. Base of abdomen not narrower or only slightly narrower than thorax.
- 2 (3). Body narrowly elongate. Elytra with parallel sides, their length about 4.0 times their total width at base 5. **Xylosteini**.
- 3 (2). Body comparatively broad, quite often coriaceous. Elytra often narrow toward apex, only 2.0 or 3.0 times longer than their total width at base.
- 4 (5). Pronotum laterally with more or less developed tubercle or small tubercular swelling. Prosternum between forecoxae and anterior margin transversely impressed, with broad transverse groove. 6. **Stenocorini**.
- 5 (4). Pronotum without lateral tubercle, barely rounded or narrows abruptly at apex; if with tubercle (genus *Eustrangalis*), elytra narrow markedly toward apex, deeply and obliquely truncate apically, with outer angle produced, subulate. Prosternum between forecoxae and anterior margin without broad transverse groove, slopes forward uniformly, sometimes only bent at anterior margin. 7. **Lepturini**.
- 6 (1). Elytra short, cover only metathorax. Hind wings exposed at rest, lie on abdomen. Base of abdomen distinctly narrower than thorax. 8. **Necydalini**.

Larvae

- 1 (6). Pronotal shield without yellowish sclerotized bands on sides, but here with or without slight longitudinal groove.
- 2 (3). Locomotory ampullae on first five (especially II to V) abdominal segments bulge markedly, resemble paired tubercular dilata-tions that extend laterally, with deep median longitudinal groove. 5. **Xylosteini**.
- 3 (2). Locomotory ampullae on first five abdominal segments bulge moderately, resemble transversely elongate prominences, with shallow median longitudinal groove.
- 4 (5). Dorsal locomotory ampullae with two transverse carinae separated by transverse groove (anterior carina small, posterior one much larger), without granules; if with granules (*Evodinus*, *Gau-rotres*, and *Acmaeops*), body flat. 6. **Stenocorini**.
- 5 (4). Dorsal locomotory ampullae without transverse smooth carinae,

- with granules forming up to four transverse rows, or with one transverse sclerotized carina with large but indistinct granules alongside it. Body not flat. 7. **Lepturini**.
- 6 (1). Pronotal shield laterally with distinct projecting, yellowish, longitudinal, sclerotized band consisting of dense minute sessile spinules, and here with deep narrow longitudinal groove. 8. **Necydalini**.

Pupae

- 1 (6). Abdomen moderately elongate, base not much narrower than thorax, and tip with moderately elongate urogomphi or without them.
- 2 (3). Abdominal tergite IX slightly emarginate along posterior margin, without urogomphi. 5. **Xylosteini**.
- 3 (2). Abdominal tergite IX with rounded or notably produced and pointed posterior margin, with distinct urogomphi or without them.
- 4 (5). Abdominal tergite IX apically produced or somewhat pointed, with pair of small contiguous urogomphi. Posterior angles of pronotum truncate or rounded. 6. **Stenocorini**.
- 5 (4). Abdominal tergite IX usually rounded apically, not pointed, with pair of urogomphi or without them; if pointedly elongate (genus *Judolia*), posterior angles of pronotum distinctly produced, not truncate. 7. **Lepturini**.
- 6 (1). Abdomen markedly elongate, base distinctly narrower than thorax, and tip with long lyrate diverging urogomphi. 8. **Necydalini**.

5. Tribe XYLOSTEINI

Four genera of the tribe Xylosteini (= Encyclopini) are found in USSR fauna. Of these, only one (*Encyclops* = *Microrrhabdium*) occurs in Far East fauna.

1. Genus *Encyclops* New.

Newman, 1838, *Entom. Mag.*, vol. 5, p. 392; Kraatz, 1879, *Deutsch. Entom. Z.*, vol. 23, p. 99 (*Microrrhabdium*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 123 (*Microrrhabdium*, type species *M. macilentum* Kr.); Gressit, 1951, *Longicornia*, vol. 2, p. 52; Kojima and Hayashi, 1969, *Insect Life in Japan*, vol. 1, p. 7 (tribe Encyclopini); Linsley and Chemsak, 1972, *Cerambycidae of North America*, vol. 69, p. 61.

Adult: Body elongate. Head with sharp cervix behind temples. Antennae long and thin; antennal segments almost cylindrical. Pronotum tubercularly produced at sides.

Larva: First six abdominal segments with developed convex granulate locomotory ampullae, segment VII (like subsequent ones) smooth, without locomotory ampullae.

Pupa: Pronotum and abdominal tergites with setae located on produced papilliform coriaceous base.

Distributed in North America and eastern regions of southern Asia. In spite of considerable diversification, some species of this genus (*Encyclops caerulea* Say and *E. ussuricus* Tsher.) have retained trophic relations with oak to the present day.

Type species: *Encyclops pallipes* Newman, 1838 (= *Leptura caerulea* Say).

KEY TO SPECIES

Adult Insects

- 1 (4). Antennae and legs mainly black. Pronotum with sparse hairs.
- 2 (3). Pronotum without median longitudinal groove, with dense large deep punctation. Ussuri-Primor'e region. 1. **E. ussuricus** Tsher.
- 66 3 (2). Pronotum with median longitudinal groove dividing disk into two longitudinal tubercles, and with grainy rugose punctation. Ussuri-Primor'e region. 2. **E. macilentum** (Kr.).
- 4 (1). Antennae and legs rusty for most part, with black spots on femora. Pronotum with dense closely adherent hairs. Kunashir, Japan. 3. **E. olivacea** Bat.

Larvae

- 1 (2). Dorsal locomotory ampullae divided by three radially divergent grooves. Abdominal tergite IX indistinctly bound by carina, more often without it, at posterior margin with slight transverse protuberance or without it. 1. **E. ussuricus** Tsher.
- 2 (1). Dorsal locomotory ampullae divided by two transverse grooves. Abdominal tergite IX distinctly bound by carina, at posterior margin with produced transverse tubercle. . . 3. **E. olivacea** Bat.

Pupae

- 1 (2). Abdominal tergites in posterior half with six setae (three setae

- on each side of midline) forming transverse row.
- 1. **E. ussuricus** Tsher.
- 2 (1). Abdominal tergites in posterior half usually with eight setae (four, rarely six on each side of midline) forming transverse row. 3. **E. olivacea** Bat.

1. **Encyclops ussuricus** Tsher.

Cherepanov and Cherepanova, 1975, *Taksonomiya i ekologiya zhivotnykh Sibiri* (Nov. i maloizv. vidy fauny Sibiri, vol. 9), pp. 56–57.

Adult (Figure 20): Differs from *Encyclops macilentum* (Kr.) in structure and punctuation of pronotum. Body slender, elongate. Head short, with distinct cervix behind temples. Cervix thin. Frons, vertex, temples, and occiput with dense even coarse punctuation. Genae short and densely punctate. Eyes large and bulge markedly, comparatively small but finely faceted, inner side either slightly emarginate or not. Antennae shorter than body, with apices extending beyond 0.75 length of elytra. First antennal segment smooth, shorter than 3rd; 5th longest, equal to 2nd and 3rd together; 3rd to 11th with short, partly erect hairs.

Pronotum somewhat longer than width at base, with broad distinct flange anteriorly, transverse groove in front of base, blunt distinct tubercle laterally, and uniformly bulging disk; medially, closer to base, sometimes with tubercular protuberance, with large dense deep punctuation and sparse long light-colored hairs that are more distinct laterally. Scutellum small, triangular, and narrowly rounded posteriorly. Legs long and slender; second half of femora thickens gradually, insignificantly. Hind tibiae slender, distinctly longer than tarsi. First segment of hind tarsi not shorter than two successive together; 3rd segment notched almost up to base. Claws long, thin, widely separated.

Elytra slightly convex and elongate, 4.0 times longer than total width at humeri, inner side with short longitudinal, barely perceptible impression on humeral tubercles; elytra narrow gently behind humeri, rounded outwardly at apex, with obtuse, barely rounded inner angle, and with dense deep even punctuation and short semierect golden hairs.

- 67 Metasternum with dense, abdominal sternites sparse notched punctuation and light-colored erect hairs. Entire body, elytra, and legs black. Antennae dark brown or black with narrow rusty ringlets at base of 6th to 10th segments. Length of male and female 6.0 to 8.0 mm.

Larva (Figure 21): Well distinguished from larvae of other species in structure of locomotory ampullae on abdominal segments I to VI. Body elongate. Head flat, rounded laterally, and with three rounded fused brownish ocelli on sides of anterior margin. Epistoma triangular, bound laterally by frontal sutures, and medially, especially in posterior half, divided by longitudinal brownish suture. Hypostoma continuous,

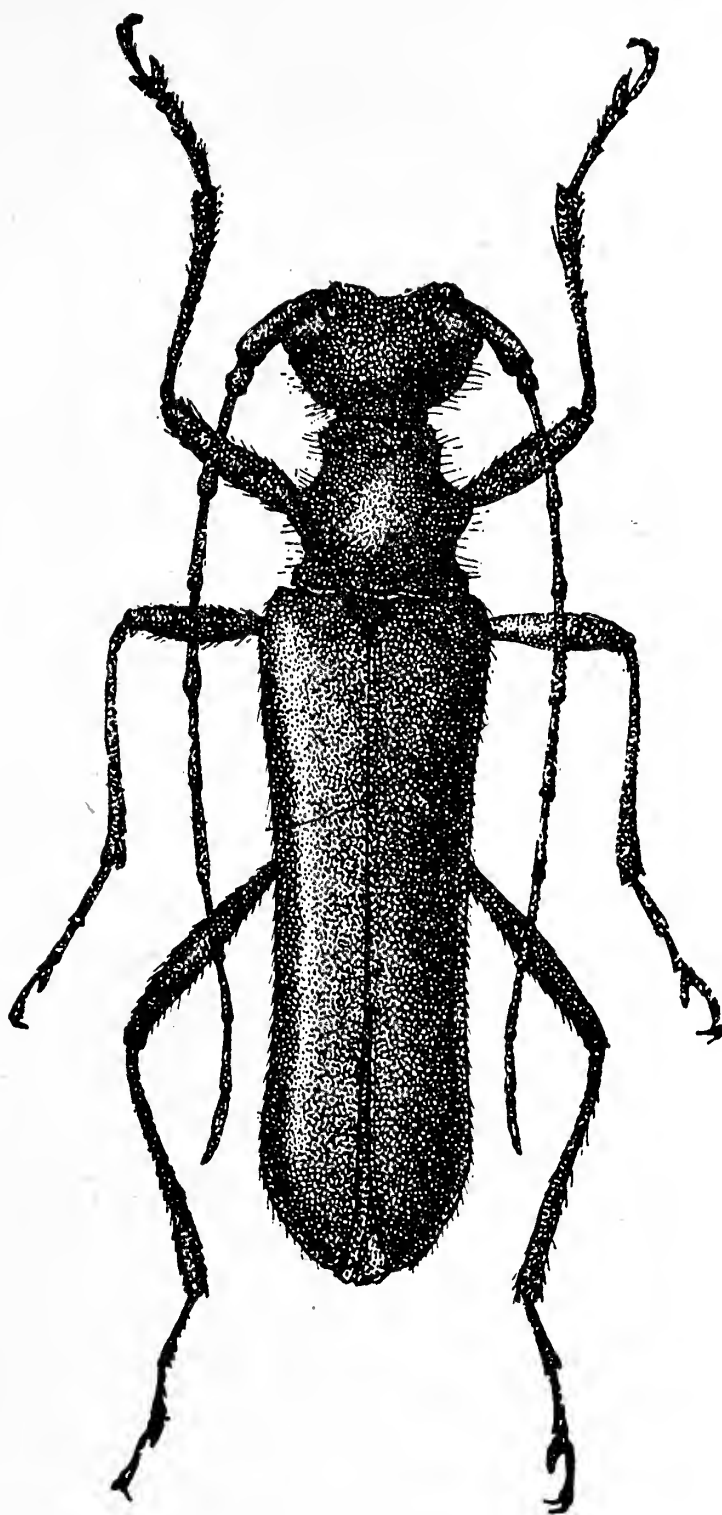
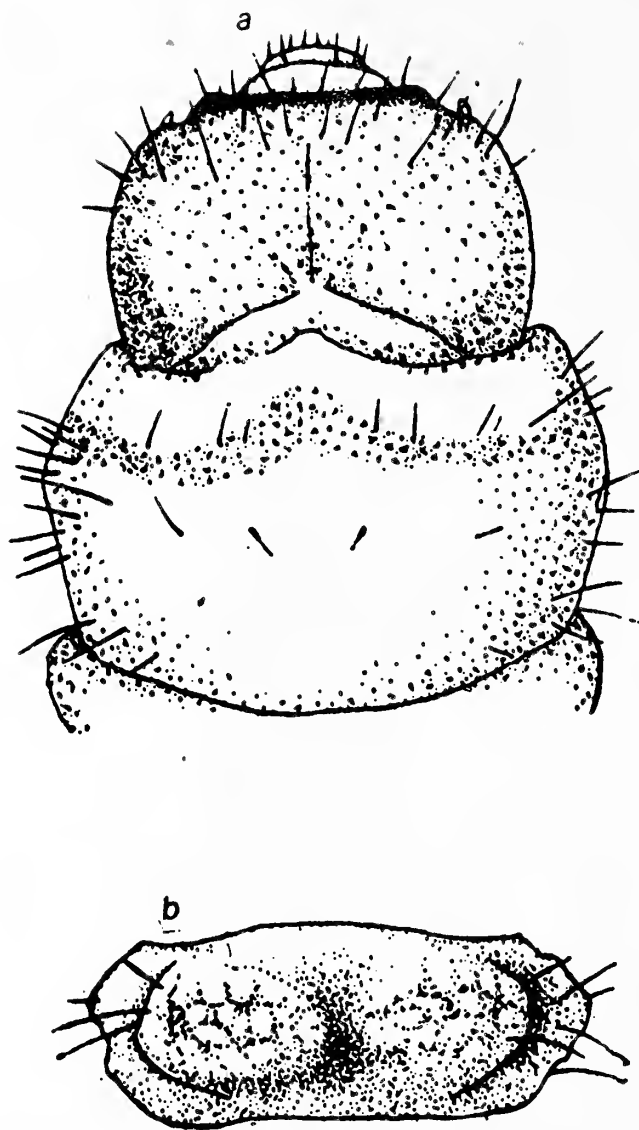


Figure 20. *Encyclops ussuricus* Tsher.

narrows slightly anteriorly, and bound laterally by straight sutures. Clypeus broad and smooth. Labrum transverse, anterior margin gently rounded, with short sparse setae. Mandibles elongate, obliquely truncate at apex.

Pronotum transverse, bulges slightly and smooth; anterior half with yellow transverse band; middle part with whitish clearances and four widely separated hairs forming transverse row; laterally with sparse long tender hairs. Pronotal shield slightly convex, not demarcated from rest of surface, and without lateral longitudinal folds. Thoracic legs short, with light-colored, barely noticeable claws.



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Figure 21. Larva of *Encyclops ussuricus* Tsher.

a—head and pronotum; b—abdominal tergite with locomotory ampulla.

Abdomen elongate, more or less narrows toward apex, and with long thin hairs laterally. Locomotory ampullae on first five segments protrude markedly, produced; on disk divided by three small radially divergent grooves forming faint minute granulation. Locomotory ampullae poorly developed on segment VI and absent on VII. Anal opening tri-radial. Body white, head yellowish-rust, mandibles reddish-rust basally and black apically. Pronotum in anterior half with yellow transverse band extending to sides. Body length of III-instar larva 9.0 to 10.0 mm.

Pupa (Figure 22): Body highly elongate. Head short, insignificantly bent under. Frons with longitudinal suture. Antennae flexed to sides, turned backward, with apices slightly bent ventrad. Pronotum convex, smooth, hyaline, medially enlarged angularly, tubercularly produced laterally, with broad flange anteriorly, on anterior margin and base laterally with setae forming transverse row. Group of setae on lateral tubercles; disk glabrous, without setae.

Abdomen highly elongate, broadens somewhat from base to segment

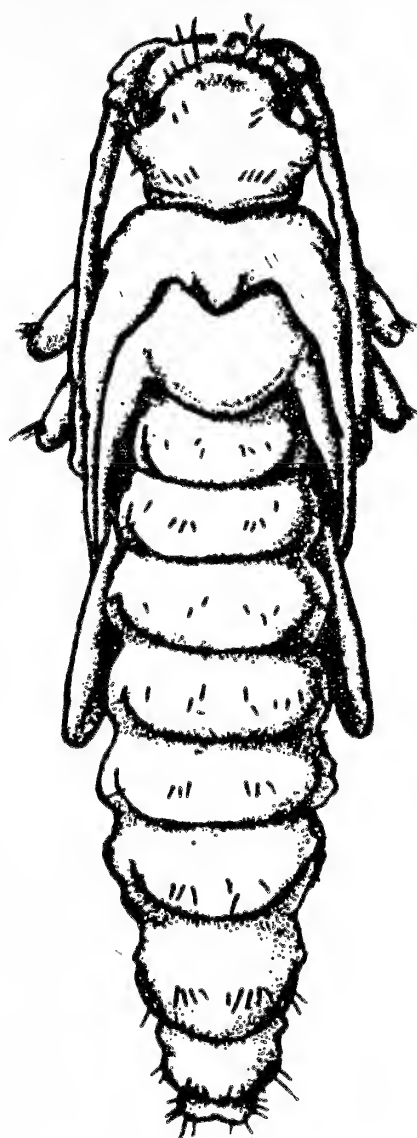


Figure 22. Pupa of *Encyclops ussuricus* Tsher.

V, narrows toward tip. Abdominal tergites dilated, behind middle with three paramedial setae each on produced base. Tergite VII in posterior half with setae forming transverse band; tergite VIII with four pairs of setae forming transverse row in posterior half. Tip of abdomen ventrolaterally with sparse long setae. Length of body 8.0 mm.

Material: Collected in Ussuri-Primor'e region (Komarovka River). Adult insects nine, larvae 45, pupae six, larval exuviae with beetles four.

Distribution: Known only from Ussuri-Primor'e region.

Biology: Inhabits oak forests. Beetles fly from end of May through June, lead a cryptic mode of life. Female lays eggs in bark of viable oak 16 to 40 cm or more in diameter at chest height. Larvae make longitudinal galleries in cork layer of bark, often around bast. Galleries made from bottom upward and plugged with frass. Width of gallery in front of pupal cell 4.0 mm. Larvae of last instar make pupal cell 12 mm long and up to 40 mm wide at end of gallery, cut an exit toward bark surface, and plug it with frass. Larvae pupate in early spring after

- 69 third hibernation. Pupa lies with head upward in pupal cell. Young beetle gnaws opening 3.0 mm \times 1.8 mm on bark surface and exits through it. Weight of larvae before pupation ranges from 10.2 to 18.6 mg, pupae 7.2 to 15.5 mg, and beetles before exiting from pupal cell 5.1 to 9.1 mg. Density of larval population in bark of viable oak comparatively high. For example, six larvae were found on bark surface in an area 108.5 cm². Larvae of *Pidonia quercus* Tsher. are often found together with this species.

2. *Encyclops macilentum* (Kr.)

Kraatz, 1879, *Deutsch. Entom Z.*, vol. 23, p. 99 (*Microrrhabdium*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 124 (*Microrrhabdium*).

Adult: Differs from that of other species of this genus (according to description available) in pronotal structure and punctuation. Body elongate, with parallel sides. Head with dense minute rugulose punctuation. Antennae long, slender, almost as long as body.

Pronotum longer than width at base, with produced tubercles laterally; disk with median longitudinal groove dividing it into two longitudinal, well-developed tubercles, with dense granular (!) striation and punctuation. Elytra long and parallel, rounded apically, with coarse dense punctuation, each elytron with one short golden hair. Body black, elytra greenish-bronze. Length 7.0 mm.

Distribution: Ussuri-Primor'e region. I could not find this species. Larva and pupa not reported and their biology not studied. Evidently a rare find.

3. *Encyclops olivacea* Bat.

Bates, 1884, *J. Linn. Soc. Lond. Zool.*, vol. 18, p. 211 (*E. olivaceus*); Kojima and Hayashi, 1969, *Insect Life in Japan*, vol. 1, p. 7 (= *E. olivacea* Bat.).

Adult (Figure 23): Characterized by very light rust color of legs and antennae and dense hair cover on pronotum. Body elongate, with parallel sides. Head short and broad, with large rounded temples and very distinct cervix behind them, unusually dense punctuation and closely adherent golden hairs; temples laterally with long setae. Eyes bulge markedly, oval, longitudinally elongate, inner side slightly emarginate. Antennae long, with apices reaching far beyond middle of elytra.

Pronotum not longer than wide, narrows near apex and base, with produced large tubercle on sides, well-defined flange on anterior margin, transverse groove at base; with minute punctuation and closely adherent hairs, away from sides toward middle and back, and stray long setae. Scutellum small, narrows somewhat posteriorly, truncate apically, and with coarse punctuation. Elytra elongate, with parallel sides, with large

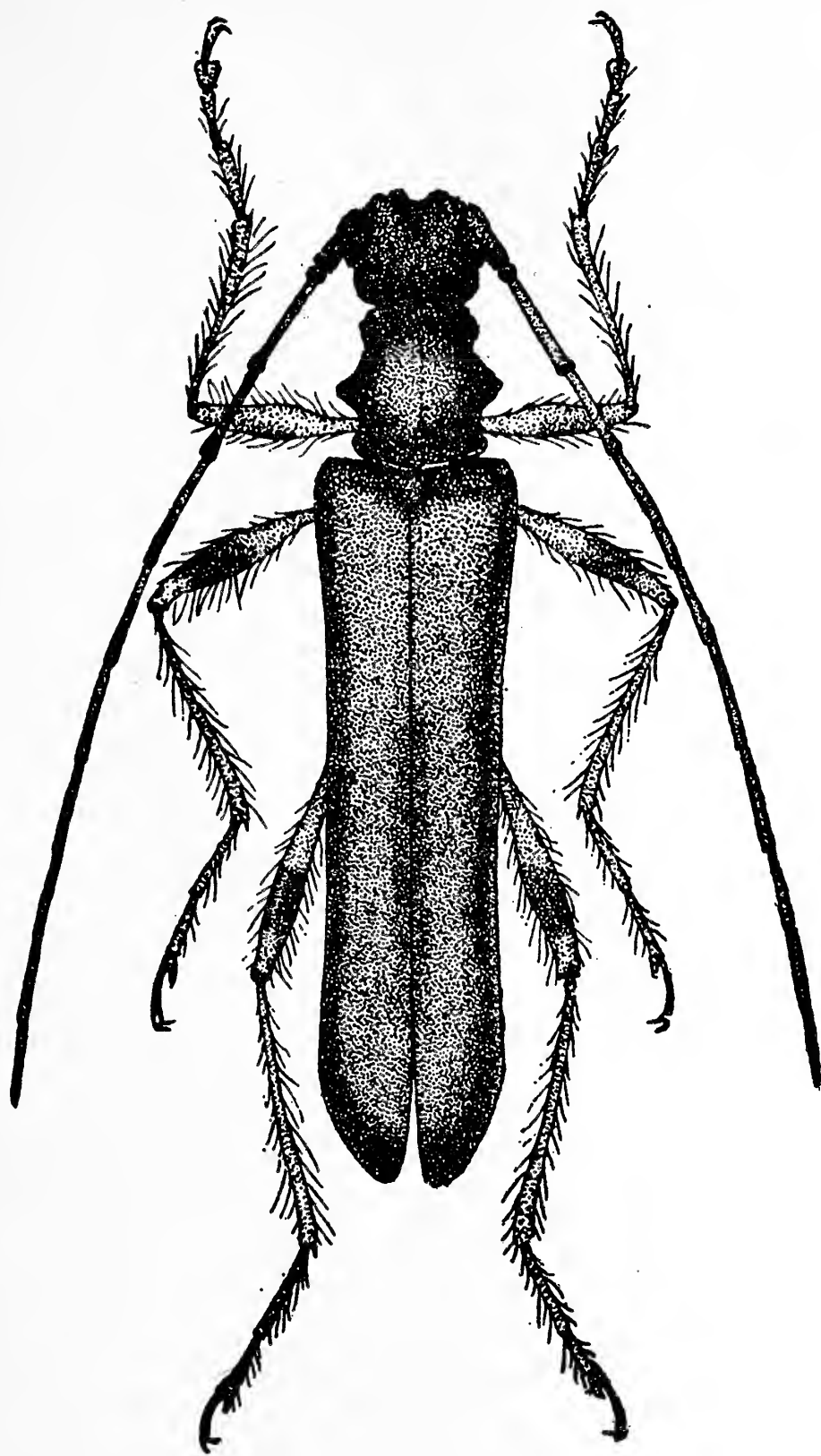


Figure 23. *Encyclops olivacea* Bat.

deep punctation forming transverse striae, sparse short, barely perceptible hairs, apically with sharp inner angle. Spaces between punctures with fine shagreen sculpture. Legs long, slender; 1st segment of hind tarsi longer than remaining segments together. Femora slightly clavate, with dense fine transverse pattern visible under high magnification. Abdominal sternites convex, with sparse indistinct punctation and fine

sculpture. Body black, elytra olive-bronze. Antennae rusty with darkened spots at end of segments. Legs light rust. Femora with black transverse spots. Body length 7.5 to 8.0 mm.

- 70 *Larva* (Figure 24): Very similar to that of *Encyclops ussuricus* Tsher. Differs in structure of locomotory ampullae and presence of distinct carinate edging on abdominal tergite IX. Body elongate. Head broad and flat, somewhat retracted into prothorax. Epistoma bound by faint frontal sutures, with median longitudinal suture distinct in posterior

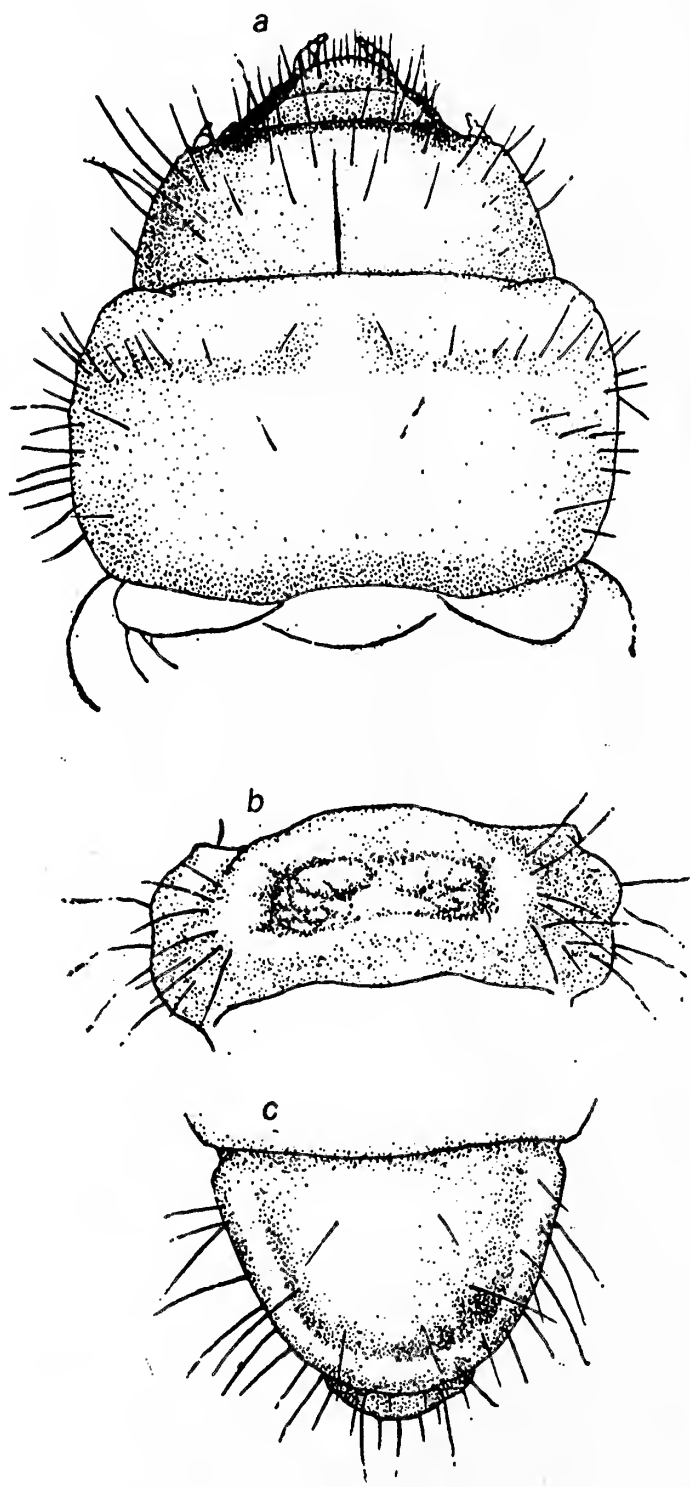


Figure 24. Larva of *Encyclops olivacea* Bat.

a—head and pronotum; b—abdominal tergite IV with locomotory ampulla; c—abdominal tergite IX.

half and imperceptible in anterior third; with six long setae forming transverse row anterior to middle, perceptible longitudinal impressions laterally, and produced, more sclerotized anterior angles at antennae. Hypostoma entire, without medial bands, and narrows slightly anteriorly. Clypeus broad and trapezoidal. Labrum slightly convex, broad, bluntly rounded in front, and with dense setae. Mandibles elongate, sharply truncate at apex.

71 Pronotum transverse, disk almost flat, with white shagreen anterior margin, lustrous with yellowish tinge in anterior half of posterior part. Pronotal shield slightly convex, smooth, and indistinctly bound laterally. Thoracic legs well developed, with long thin claw.

Abdomen narrows toward apex, with stray long hairs on sides. Dorsal locomotory ampullae highly convex, developed on six segments; each ampulla divided by two transverse grooves and granulate. Abdominal tergite VII smooth, without locomotory ampullae. Ventral locomotory ampullae with two rows of large granules. Tergite IX distinctly bound by lateral carina and produced transverse tubercle on dorsal side. Body white; anterior margin of head and mandibles reddish-brown, almost black. Transverse band in anterior half of pronotum rusty. Body length 8.0 to 10.0 mm.

Pupa (Figure 25): Body elongate. Head short and broad, moderately bent under; antennal bases tubercularly convex, with long setae here and behind antennae. Antennae flexed to sides, posterior half curved, annular.

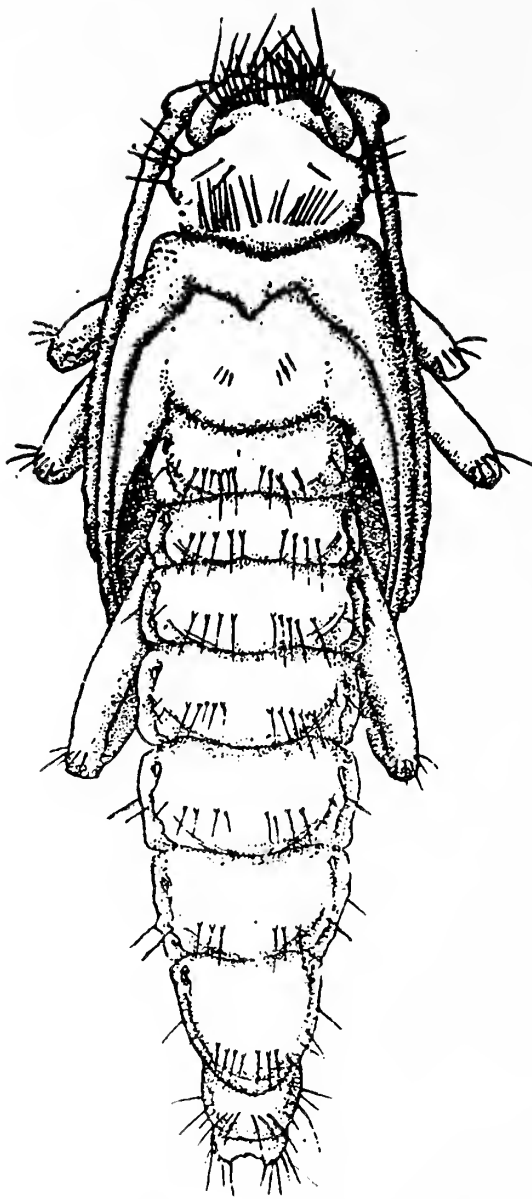
Pronotum angularly produced (enlarged) laterally, narrows markedly toward apex, less posteriorly; anterior and posterior margin of pronotum with long setae forming dense transverse row. Metanotum behind middle with fine setae forming two tufts of four setae each.

72 Abdomen elongate, broadens somewhat in region of segment IV. Abdominal tergites convex, in posterior half with long acicular sessile setae on produced bases forming transverse row interrupted medially (eight setae per row). Tip of abdomen obtuse, laterally with sparse thick setae along margins. Valvifers of female large, narrow somewhat toward base, slightly truncate at apex. Body length 8.0 to 9.5 mm.

Material: Collected in Kunashir in forests close to Alekhino and Sernovodsk settlements. Adult insects (from pupae) five, larvae 27, pupae two, and larval exuviae with beetles from cells two.

Distribution: Kunashir; Japan.

Biology: Inhabits broad-leaved forests. Ecologically associated with viable thick-trunked trees. Flight of beetles evident in first half of summer. Female lays eggs in bark of viable oak trees. Larvae make meandering longitudinal galleries in cork layer of bark and plug them with frass. Pupal cell lies at end of gallery, its length up to 10 mm, width



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Figure 25. Pupa of *Encyclops olivacea* Bat.

about 4.0 mm. Pupae seen in May and early June. Beetles sighted in last few days of May and in June. Weight of larvae before pupation ranges from 18 to 28 mg, pupae 13.0 to 24.9 mg, and beetles 10 to 20 mg. Colonizes trees, mainly in sparse plantations and forest clearances and meadows.

6. Tribe STENOCORINI

Adult insect characterized by longitudinal grooves on prosternum anterior to forecoxae. Pronotum laterally with produced tubercle (*Rhagium*, *Toxotus*, *Stenocorus*, *Brachyta*, and others) or without it (*Pidonia* and *Pseudallosterna*); in latter genus tubercle on disk more convex.

Larva with thick (*Stenocorus*, *Brachyta*, and others) or flat body (*Gaurotes*, *Acmaeops*, and others). Apex of abdominal tergite IX with one (*Stenocorus*, *Brachyta*, *Evodinus*, some species of *Rhagium*, and

others) or two (*Toxotus*) spinules, or without them (*Acmaeops*, *Sieversia*, *Pidonia*, and others), rarely with long coriaceous process (*Rhamnusium*).

Pupa usually with hind femora markedly curved toward dorsal side and pronotum with rounded posterior angles. Abdominal tergites in pupae with long setae, rarely with spinules (*Rhagium*). Abdominal tergite IX of pupa with pair of small urogomphi, or with one spinule, or with produced tubercle at apex.

This tribe consists of a comparatively large number of genera and species inhabiting broad stretches of the Holarctic region. In ecological characteristics they are restricted to forests. Some species are associated with deciduous, others with coniferous species, while still others prefer herbaceous vegetation. Some species change habitat in the course of their development: larvae live under bark of trees while pupae develop in soil. Emergence of larvae for pupation in soil is generally completed in autumn, rarely in spring.

KEY TO GENERA

Adult Insects

- 1 (14). Pronotum laterally with well-developed, sometimes pointed tubercles.
- 2 (7). Lateral tubercles on prothorax produced, spinescent, pointed; if obtuse (*Rhamnusium*), prosternal process thin, extends beyond forecoxae.
- 3 (4). Prosternal process between forecoxae with parallel sides, straightly truncate at apex, not pointed, and does not extend beyond forecoxae. 1. **Rhagium** F.
- 4 (3). Prosternal process between forecoxae narrows posteriorly, pointed at apex, extends beyond forecoxae.
- 5 (6). Temples well developed, eyes project slightly behind them. 2. **Rhamnusium** Latr.
- 6 (5). Temples poorly developed, eyes project markedly behind them. 3. **Toxotus** Zett.
- 7 (2). Lateral tubercles on pronotum not produced, in form of round or conical prominences.
- 8 (9). Hind tibiae deeply notched at apex, spurs at level of upper edge of notch. 4. **Stenocorus** F.
- 9 (8). Hind tibiae not deeply notched at apex, at most slightly truncate; spurs almost at level of edge of apex.
- 10 (13). Pronotum laterally produced conically or tubercularly. Hind tarsi comparatively thick, 1st segment not longer or only slightly longer than others.

- 11 (12). Third segment of hind tarsi elongate, bifurcate up to half or less its length. 5. **Pachyta** Zett.
- 12 (11). Third segment of hind tarsi not elongate, bifurcate up to more than half its length. 6. **Brachyta** Fairm.
- 13 (10). Pronotum laterally with faint tubercles. Hind tarsi slender, 1st segment somewhat longer than others. 7. **Evodinus** LeConte
- 14 (1). Pronotum laterally without well-developed tubercles; tubercles small (*Sieversia*, *Pseudosieversia*) or barely visible diffuse tubercular swellings present.
- 15 (18). Elytra usually with metallic sheen, rugose sculpture, or large deep punctation.
- 16 (17). Elytra coarsely rugose, with transverse yellow band medially. 8. **Sachalinobia** Jacobs.
- 17 (16). Elytra not rugose, with large deep punctation and without transverse yellow band. 9. **Gaurotes** J. Lec.
- 18 (15). Elytra without distinct metallic sheen, with minute punctation.
- 19 (26). Pronotum bulges uniformly on disk, sometimes with median longitudinal groove, and more or less sparse, moderately small punctation.
- 20 (21). Pronotum with deep median longitudinal groove, and paramedial tubercular prominences on disk. . . . 10. **Lemula** Bat.
- 21 (20). Pronotum without median longitudinal groove, or with barely visible groove-shaped line (*Pseudosieversia*), without tubercular prominences on disk.
- 22 (23). Body comparatively short, coriaceous, slightly elongate. Pronotum laterally rounded, with slight protrusion. 11. **Acmaeops** LeConte
- 23 (22). Body elongate, long, with parallel sides. Pronotum laterally with minute but distinct tubercle.
- 24 (25). Scutellum black; elytra matte, red (male, female). 12. **Sieversia** Ganglb.
- 25 (24). Scutellum red; elytra not matte, somewhat lustrous, reddish-rust (male) or black (female). 13. **Pseudosieversia** Pic
- 26 (19). Pronotum often bulges markedly on disk, domelike, without median longitudinal groove, and with dense punctation.
- 27 (28). Antennae do not thicken toward apex. Head and pronotum with identical simple and deep punctation. 14. **Pidonia** Muls.
- 74 28 (27). Antennae thicken toward apex. Head seems to have much larger flat dense punctation. 15. **Pseudallosterna** Plav.

Larvae

- 1 (2). Pronotum with dense hairs forming transverse stripe (interrupted only medially) that merges with lateral pubescent fields. Found on wind-fallen and decaying trees under bark. 1. **Rhagium** F.
- 2 (1). Pronotum with sparse (stray) hairs that do not form distinct transverse stripe.
- 3 (4). Posterior margin of abdominal tergite IX with long coriaceous setaceous process. 2. **Rhamnusium** Latr.
- 4 (3). Posterior margin of abdominal tergite IX without long coriaceous setaceous process, with one or two sclerotized spinules.
- 5 (6). Posterior margin of abdominal tergite IX with two thick short sclerotized spinules. Dorsal locomotory ampullae with well-developed granules that form complete distinct transverse rows. Found on wind-fallen and dead trees. 3. **Toxotus** Zett.
- 6 (5). Posterior margin of abdominal tergite IX with sclerotized spinule or without it.
- 7 (22). Locomotory ampullae developed on seven abdominal segments.
- 8 (15). Dorsal locomotory ampullae without granules, divided by transverse grooves into two transversely elongate carinae.
- 9 (14). Pronotal shield glabrous, rarely with stray short setae. Sides of head (parietals) in anterior half with sparse setaceous hairs.
- 10 (11). Pronotal shield sclerotized at base. Locomotory ampullae of abdomen with minute sclerotized spinules resembling fine granules (visible under high magnification). Found on roots of decaying trees. 4. **Stenocorus** F.
- 11 (10). Pronotal shield coriaceous at base, not sclerotized. Locomotory ampullae of abdomen without sclerotized spinules, coriaceous, larger ones shagreen.
- 12 (13). Locomotory ampullae on abdomen shagreen. Spine on posterior margin of segment IX acicular, thin, with acute tip. Found on roots of dead and decaying trees. 5. **Pachyta** Zett.
- 13 (12). Locomotory ampullae on abdomen coriaceous, smooth, not shagreen. Spine on posterior margin of segment IX not acicular, not acute at tip, more often rounded or cuneiformly truncate and appears acute. Found on roots of herbaceous vegetation. 6. **Brachyta** Fairm.
- 14 (9). Pronotal shield with numerous short (sometimes elongate) setae. Parietals in anterior half with dense thick setaceous hairs. Found in timber of coniferous trees. 8. **Sachalinobia** Jacobs.

- 15 (8). Dorsal locomotory ampullae with granules that form transverse rows.
- 16 (17). Pronotum basally with dense sclerotized spinules that form transverse rusty stripe. Posterior margin of abdominal tergite IX produced, with long sharp sclerotized spine. Found under bark of coniferous trees. 7. **Evodinus** LeConte
- 17 (16). Pronotum basally without sclerotized spinules. Posterior margin of abdominal tergite IX not produced, with minute, sometimes barely perceptible spinule or without it.
- 75 18 (19). Posterior margin of abdominal tergite IX with spinule. Found under bark of decaying trees. 9. **Gaurotes** LeConte
- 19 (18). Posterior margin of abdominal tergite IX without spinule.
- 20 (21). Epistoma anterior to middle with transverse white band. Found under bark of coniferous and deciduous species. 11. **Pcmaeops** LeConte
- 21 (20). Epistoma anterior to middle without transverse white band. Found on bark of willow, aralia, and fir. 15. **Pseudallosterna** Plav.
- 22 (7). Locomotory ampullae developed on six abdominal segments.
- 23 (26). Abdominal tergite IX flat, 2.0 times wider than long, gently rounded posteriorly. Apices of mandibles truncate or somewhat obliquely clipped, with lower tip more acute.
- 24 (25). Posterolateral setae on dorsal side of head located along inner side of frontal sutures. Found on roots and in underground zone of trunks of viable small-fruited trees. 12. **Sieversia** Ganglb.
- 25 (24). Posterolateral setae on dorsal side of head located along outer side of frontal sutures. Found on roots and in underground zone of trunks of viable and decaying ash, Manchurian walnut, and other deciduous species. . . . 13. **Pseudosieversia** Pic
- 26 (23). Abdominal tergite IX not flat, broadens negligibly, its width not more or only slightly more than length. Apices of mandibles truncate or sometimes clipped twice (lower notch narrow and deep, upper one broad), appear tridentate. With time, denticles wear down and mandibles become obliquely truncate at apex. Found on roots and under bark of deciduous and coniferous trees. 14. **Pidonia** Muls.

Pupae

- 1 (2). Abdominal tergites with spinules. 1. **Rhagium** F.
- 2 (1). Abdominal tergites with long setae.
- 3 (6). First four to five abdominal tergites with tubercular prominences.

ces and densely covered with setae that form two tufts on each tergite.

- 4 (5). Apex of abdominal tergite IX upturned. Tubercular setaceous prominences on metanotum and initial abdominal tergites sharp, project high above surface as individual setae and form two distinct longitudinal rows. Found in soil, among roots of wood species. 4. **Stenocorus** F.
- 5 (4). Apex of abdominal tergite IX not upturned. Tubercular setaceous prominences on metanotum and initial abdominal tergites partly indistinct, barely project above surface as setaceous protrusions. Found in soil, among roots of herbaceous vegetation. 6. **Brachyta** Fairm.
- 6 (3). Initial abdominal tergites without tubercular prominences, rarely present only on first two tergites (*Evodinus*), with setae forming transverse stripe or row.
- 7 (8). Metanotum with pair of sharply produced, nodular setaceous prominences. Found in soil, among roots of wood species. 5. **Pachyta** Zett.
- 8 (7). Metanotum without sharply produced prominences; at most, with small indistinct protrusions covered with setae forming two tufts.
- 76 9 (10). Posterior margin of abdominal tergite IX produced, with sharp sclerotized spinule. First two abdominal tergites with small tubercular prominences. Found in soil, under coniferous trees. 7. **Evodinus** LeConte
- 10 (9). Posterior margin of abdominal tergite IX not produced, without sharp sclerotized spinule; at most, with tubercle or two small spinescent processes; if with spinule, then first two abdominal tergites without prominences.
- 11 (12). First two abdominal tergites, and especially metanotum, with thick dense setae forming two tufts on each of them. Abdominal tergites III to IV almost glabrous, with only stray tender setae, not forming tufts. Found in timber of coniferous species. 8. **Sachalinobia** Jacobs.
- 12 (11). First two and subsequent abdominal tergites with stray, comparatively long thin setae, which form transverse band or row in posterior half.
- 13 (14). Pronotal disk glabrous, without setae. Found in soil, under trees. 11. **Gaurotes** LeConte
- 14 (13). Pronotal disk with stray or dense setae.
- 15 (16). Pronotal disk with stray setae. Found in soil, under trees, or under bark of coniferous trees. . . . 11. **Acmaeops** LeConte
- 16 (15). Pronotal disk usually with setae that form tufts or transverse stripe.

- 17 (20). Pronotum bulges slightly; posterior half with long setae that form two large tufts which almost fuse (*Sieversia*). Scutellum of mesonotum negligibly produced.
- 18 (19). Pronotum in posterior half entirely covered with thick setae. Found in soil under small-fruited trees. 12. **Sieversia** Ganglb.
- 19 (18). Pronotum in posterior half, anterior to dense transverse row of setae, glabrous, and only in middle of disk with long setae arranged in transverse stripe. Found in soil under thick-trunked trees, around roots of ash and other deciduous species. 13. **Pseudosieversia** Pic
- 20 (17). Pronotum sometimes bulges markedly, domelike; in posterior half laterally with stray setae that form two small, widely separated tufts or two rows which turn away from anterior angles posterior to middle. Scutellum of mesonotum usually highly produced. Found in soil under deciduous and coniferous species. 14. **Pidonia** Muls.

1. Genus *Rhagium* F.

Fabricius, 1775, *Syst. Entom.*, p. 182; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 131–133; Linsley and Chemsak, 1972, *Cerambycidae of North America*, 69, 6, 84–85.

Adult: Body stocky. Cervix elongate. Temples distinct. Antennae short, with apices barely reaching beyond pronotal base. Eyes bulge, finely faceted, poorly emarginate. Pronotum laterally with sharply produced, spinescent tubercles.

Larva: Characterized by flat head, more flattened on anterior margin, and more or less rounded laterally. Legs long, with thin, insignificantly sclerotized claws. Posterior margin of tergite IX with or without spinule.

Pupa: Anterior and posterior margins of pronotum with acicular setae forming transverse row. Abdominal tergites with sharp spinules. Sternites with tubercular protuberances laterally.

- 77 All species of this genus are distributed in Eurasia except for one [*Rhagium inquisitor* (L.)], which belongs to North America.

Type species: *Cerambyx inquisitor* Linnaeus, 1758.

KEY TO SPECIES

Adult Insects

- 1 (2). Temples behind eyes short and smooth, glabrous, without hairs, posteriorly without projection, gently truncate. Elytra with minute

- sharp longitudinal ridges. 1. **R. inquisitor** (L.).
- 2 (1). Temples behind eyes long, with sparse or dense punctation, covered with hairs; posteriorly with sharp almost right-angled projection. Elytra with faint minute longitudinal ridges.
- 3 (4). Bases of elytra, lateral to scutellum, smooth, without tubercle, medially with distinct black transverse band, more prominent laterally and replicated on disk. 2. **R. mordax** (Deg.).
- 4 (3). Bases of elytra, lateral to scutellum, with distinct tubercle, medially with diffuse brownish transverse band.
- 3. **R. sycophanta** (Schr.).

Larvae

- 1 (2). Epistoma on anterior margin with dense hairs forming four tufts (on anterior angles and laterally at base of clypeus). Posterior margin of abdominal tergite IX rounded, not produced, without spinule. Found on conifers. 1. **R. inquisitor** (L.).
- 2 (1). Epistoma on anterior margin with stray hairs that do not form tufts. Posterior margin of abdominal tergite IX produced or with spinule.
- 3 (4). Posterior margin of abdominal tergite IX with spinule; if without it, then with sclerotized border. 2. **R. mordax** (Deg.).
- 4 (3). Posterior margin of abdominal tergite IX without spinule. . . .
- 3. **R. sycophanta** (Schr.).

Pupae

- 1 (2). Tubercular protuberances on sides of abdominal sternites with long acicular setae. 1. **R. inquisitor** (L.).
- 2 (1). Tubercular protuberances on sides of abdominal sternites with short sharp spinules. 2. **R. mordax** (Deg.).

1. **Rhagium inquisitor** (L.)

Linnaeus, 1758, *Syst. Nat.*, 10th ed., p. 406 (*Cerambyx*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 141-145; Linsley and Chemsak, 1972, *Cerambycidae of North America*, 69, 6, 85-88.

Adult (Figure 26): Characterized by presence of distinctly visible minute longitudinal carinae on elytra. Head with coarse punctation, minute gray adherent hairs, and behind eyes, above and below temples, with long erect hairs. Temples short, smooth, glabrous, truncate posteriorly and do not project. Cervix elongate. Antennae short, with apices reaching beyond pronotum, proximate at base, thicken notably in second half, and from 6th segment matte, with minute adherent hairs.

- 78 Pronotum narrows more toward apex and less toward base, with broad flange anteriorly, transverse groove basally, and laterally produced into sharp spinescent tubercles; with uneven coarse punctation, adherent gray hairs, and medially with smooth longitudinal stripe. Scutellum triangular, flat, basally broad; with minute shagreen sculpture, sparse punctation, and adherent hairs (laterally).

Elytra convex, rounded apically, with minute longitudinal smoothly raised ridges and coarse uneven punctation, transverse raised striation

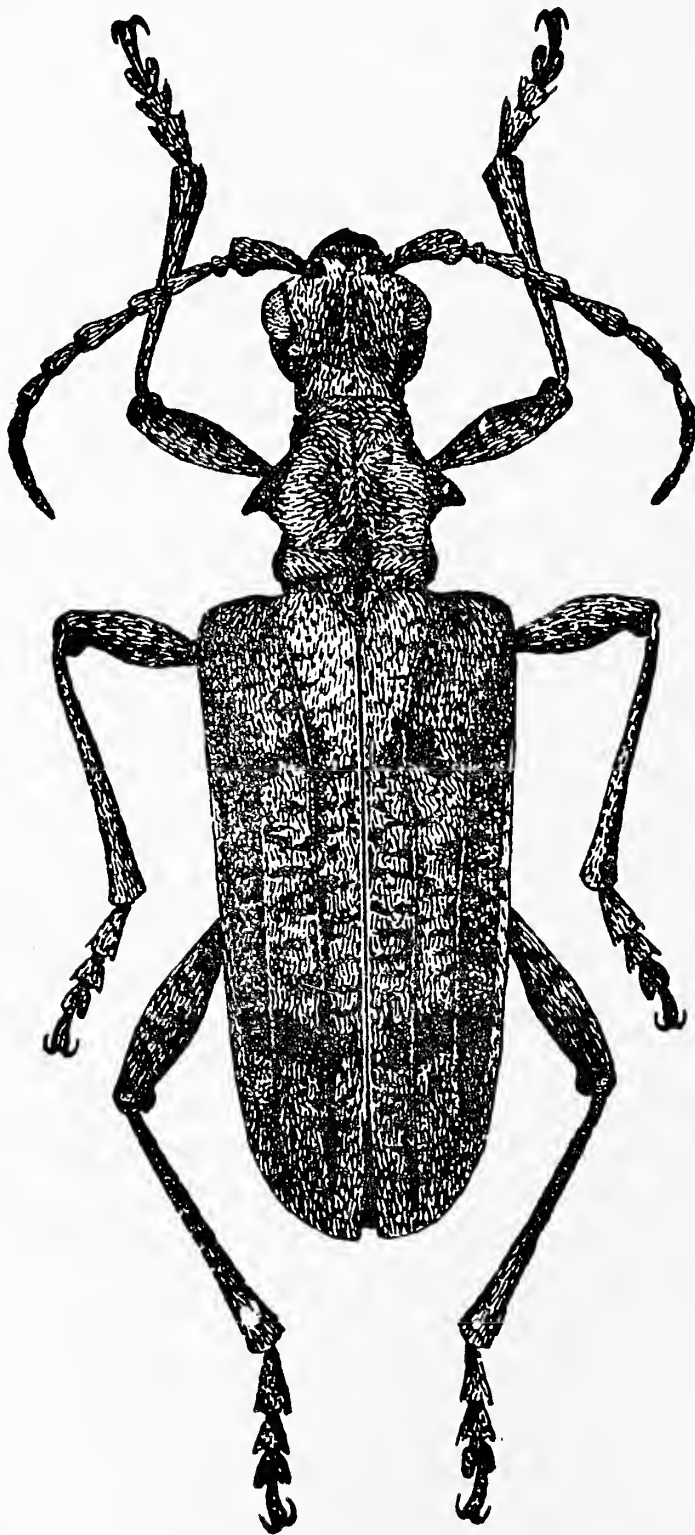


Figure 26. *Rhagium inquisitor* (L.).

and uneven pubescence. Body ventrally with adherent and partly erect hairs. Body black. Elytra variegated, usually black with transverse yellow or gray bands; sometimes in posterior third with dark black bands. Length of body in male and female 14 to 20 mm.

Egg: Elongate, rounded, white at poles, more enlarged in one half. Chorion with dense cellular sculpture. Length 1.8 mm, width 0.5 mm.

Larva (Figure 27): Differs from larvae of other species in flat broad head not retracted into prothorax. Body elongate. Head broad and flat, flattened on anterior margin, rounded laterally, and narrower toward base. Epistoma flat and triangular, with well-developed sutures (sutura frontalis and sutura medialis); setae medially on anterior margin usually in four tufts. Clypeus large, trapezoidal, smooth. Labrum transversely oval, basally smooth, with long dense setae in anterior half. Hypostoma entire, bulges slightly, bound laterally by parallel sutures, with white median longitudinal stripe, two transversely striate dents in posterior half and long piliform setae along sides of longitudinal white stripe.

Pronotum transverse and flat, narrows notably toward base, with dense hairs—long laterally and short basally—forming transverse band, and sparse hairs on anterior margin forming transverse row. Pronotal shield flat and smooth, not demarcated from general surface. Thoracic legs well developed, with long setae; claws small, poorly sclerotized. Dorsal locomotory ampullae moderately convex, divided by common longitudinal groove, with three transverse grooves, and more or less
79 granulate along sides. Ventral locomotory ampullae with two transverse

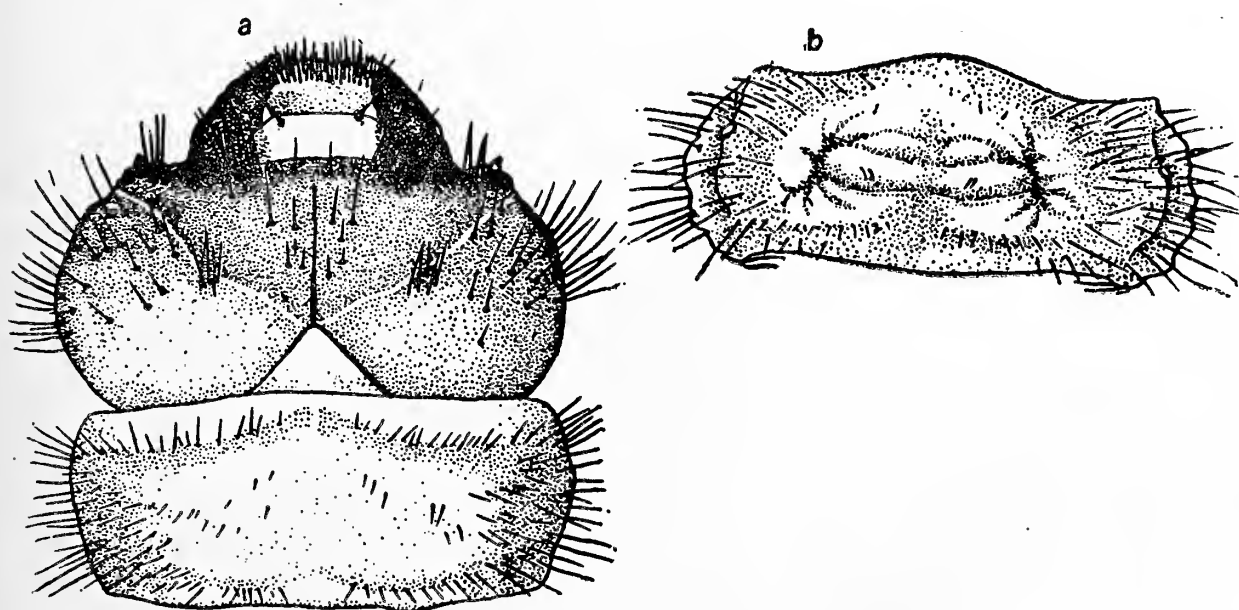


Figure 27. Larva of *Rhagium inquisitor* (L.).
a—head and pronotum; b—abdominal tergite IV.

rows of granules, divided by transverse groove. Posterior margin of abdominal tergite IX narrowly rounded, with oblique narrow grooved dents laterally in anterior half, and long hairs in posterior half. Head rusty-red. Mandibles black. Anterior margin of pronotum with white border; anterior to middle with rusty transverse band. Length of last-instar larvae 30 to 35 mm, width of cephalic capsule 6.0 to 6.5 mm.

Pupa (Figure 28): Body stocky. Head moderately bent under. Anterior margin near base of clypeus with thick setae forming transverse, medially interrupted row. Long setae near antennal bases and behind eyes. Antennae short, flexed to sides. Pronotal disk slightly convex, with distinct flange on anterior margin, laterally with produced tubercles directed upward and pressed against posterior angles; thick setae form transverse row on anterior and posterior margins, and thin setae cover anterior half of disk and lateral tubercles. Mesonotum basally with minute setae, metanotum laterally in middle.

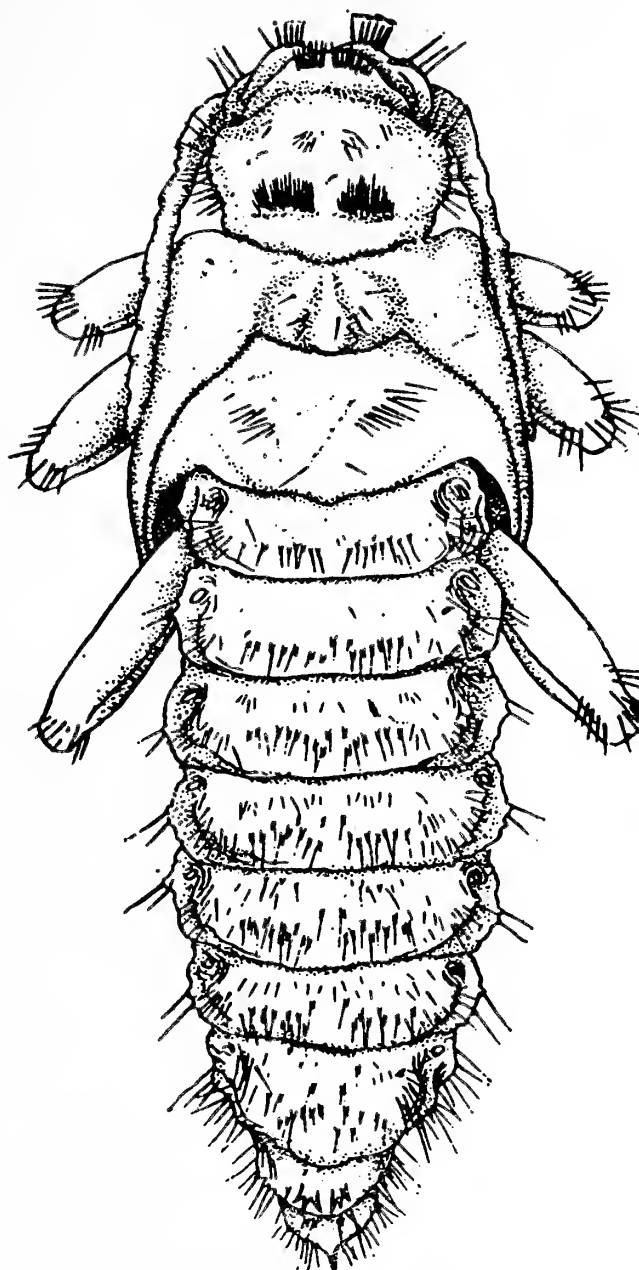
Abdomen in region of tergites III to V broadens slightly and narrows at tip. Abdominal tergites convex and, mainly in posterior half, with sharp setaceous spinules forming indistinct transverse row. Abdominal sternites laterally bulge tubercularly, with long setae here. Tip of abdomen with large sclerotized spine directed downward. Valvifers of female hemispherical and contiguous. Body length 16 to 22 mm.

- 80 *Taxonomic remarks:* *Rhagium inquisitor inquisitor* (L.) is distributed in the Trans-Urals up to Altai, *R. i. rugipenne* Reitt. from Altai to the Pacific Ocean coast, and *R. i. japonicum* Bat. on Kunashir Island and in Japan. However, there are no distinct morphological differences between these subspecies. Elytra of *R. i. inquisitor* (L.) grayed, with indistinct transverse black bands. Head of larvae broad, narrows markedly toward base; abdominal tergite IX broad, almost transverse, flattened more. Elytra of *R. i. rugipenne* Reitt. with distinct black pattern. Head of larvae uniformly rounded laterally and usually narrows less at base than at apex. Abdominal tergite IX comparatively narrower, more elongate, and not flattened.

Material: Collected in region of coniferous forests in western and eastern Siberia, in Sakhalin and Kunashir. Adult insects 1,009, larvae 1,589, and pupae 140.

Distribution: Holarctic: Eurasia from Atlantic to Pacific Ocean coasts; North America, northern Africa.

Biology: Inhabits coniferous vegetation. Flight of beetles from May through July. Female lays eggs in bark crevices, sometimes several at same site. One female can lay 49 to 120 eggs. Colonizes decaying trees, wind-fallen dead trees, processed timber of larch, maple, pine, fir, spruce, and other coniferous species. Larvae appear two to three weeks after oviposition, bore bark, make galleries there, and plug them with



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Figure 28. Pupa of *Rhagium inquisitor* (L.).

frass. Under these conditions bast is damaged but alburnum remains unaffected. Larvae hibernate and after hibernation continue to make meandering or platformlike galleries. In July–August they make pupal cell at end of gallery, slightly deepening it in top layer of wood, line sides of cell with large fibrous frass, and pupate. Length of pupal cell 20 to 25 mm, width 15 to 16 mm. Thickness of frass bed inside cell 5.0 to 18.0 mm.

En masse pupation occurs in western Siberian forests in second half of July and in August. First pupae detected toward end of July and last (late ones) up to mid-September. Emergence of young beetles mainly finished in August and September. Beetles overwinter and with onset of warm weather the following summer begin to reproduce. Weight of larvae before prepupal phase ranges from 180 to 552 mg, in

prepupal phase 120 to 540 mg, pupae 73 to 344 mg, and beetles before hibernation 53.5 to 272.0 mg. Weight of young beetles during development from pupae decreases by 24.1 to 39.9%, of females (average) by 25.4, of males 35.1%.

Costate beetles of this species are sighted in large numbers in freshly felled trees, in forests damaged by fire, and also by Siberian silkworm (*Dendrolimus sibiricus* Tschetv.) and other pests. This species generally colonizes tree trunks in the region of thick and transient bark. Quite often colonizes timber, stumps, and remnants in clearances. This species reaches a height of 2,000 m in mountains. Found in Kolyushtu area in Altai. *Acanthocinus carinulatus* Gebl., *Tetropium gracilicorne* Reitt., and others are often found together with this species under bark. All of them colonize conifers.

2. *Rhagium mordax* (Deg.)

De Geer, 1775, *Mem. Ins.*, p. 124 (*Leptura*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 137-138; Duffy, 1953, *Monograph. Immat. Stages of British and Imp. Timb. Beetles*, pp. 125-127; Cherepanov and Cherepanova, 1975, *Zhuki-drovoseki ivovyykh lesov Sibiri*, pp. 25-26.

Adult (Figure 29): Body massive. Head elongate, with distinct cervix behind temples. Frons with narrow longitudinal suture, raised margin at base of antennae, and with adherent hairs. Temples long, 81 matte, rarely punctate, with long erect hairs in lower part. Eyes convex, finely faceted, inner side slightly emarginate. Antennae short, with apices reaching beyond base of elytra. First antennal segment thickens toward apex, not shorter than 2nd and 3rd together.

Pronotum constricts at base, more so at apex, tubercularly protrudes on disk paramedially, and with lateral produced tubercle directed upward; with coarse uneven punctation and adherent gray hairs directed medially and backward. Scutellum elongate, triangular, pointed or narrowly rounded, matte at apex, usually with dense hairs. Elytra convex and parallel, narrowly rounded toward apex, rounded at inner angle, with one (lateral) short and two long longitudinal ridges, basally with large coarse punctation, posterior half with less perceptible punctation, and with closely adherent gray hairs. Legs comparatively long; femora thicker in male, notably thinner in female; hind tibiae considerably longer than tarsi.

82 Abdomen narrows gradually toward tip. Posterior margin of sternite V and tergite V in female broadly emarginate, in male straightly truncate, sometimes with produced posterior angles. Body black. Antennae dark brown, much lighter, rusty, at tip. Elytra dark brown, mediolaterally with black spot that extends toward suture; anteriorly and posteriorly bordered by light rusty band; epipleura of elytra rusty. Some-

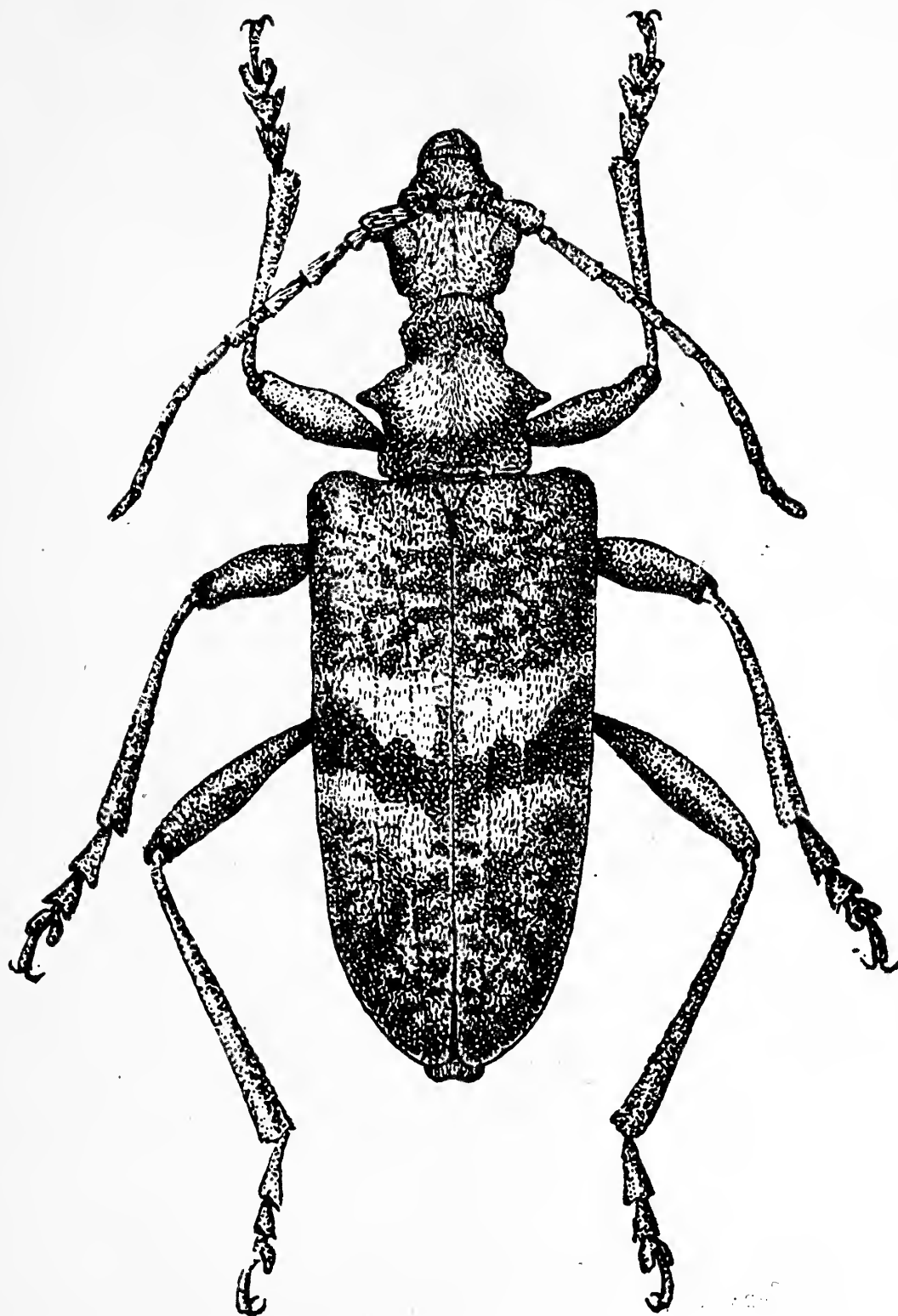


Figure 29. *Rhagium mordax* (Deg.).

times entire posterior half of elytra beyond black spot light rust with yellowish tinge (ab. *altaiense* Plav.). Body length 16 to 26 mm.

Egg: White, elongate, bluntly rounded at poles, and with distinct cellular sculpture. Cells at one pole large with spinescent produced spaces between them, elsewhere with minute smooth spaces. Length 1.8 mm, width 0.6 mm.

Larva (Figure 30): Characterized by spine on tip of abdomen. Body large and thick. Head flat, rounded laterally, somewhat bent downward,

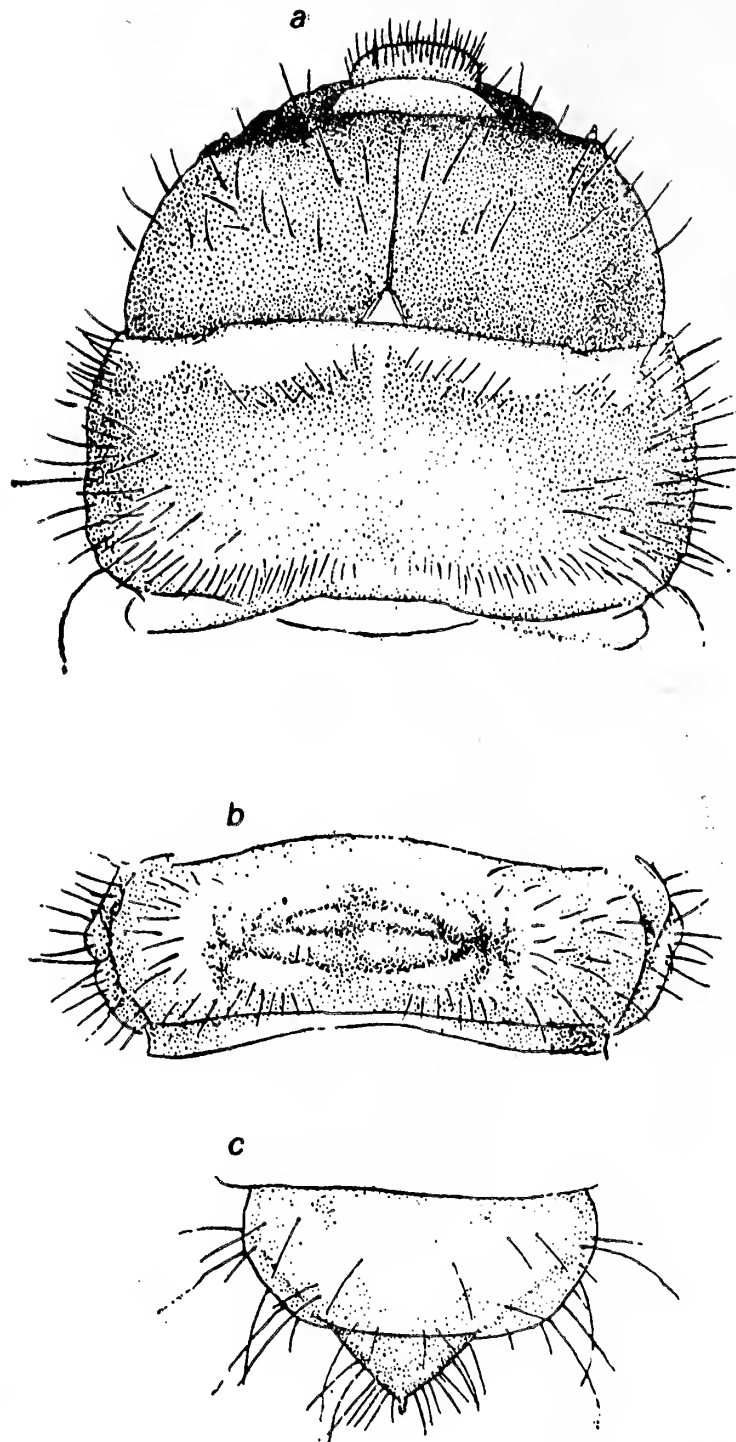


Figure 30. Larva of *Rhagium mordax* (Deg.).

a—head and pronotum; b—tergite with locomotory ampulla;
c—tip of abdomen.

transverse, and almost not retracted into prothorax. Epistoma triangular, posteriorly pointed, bound by distinct frontal sutures, with median
83 longitudinal suture, in anterior half with four setaceous pores forming transverse row. Hypostoma transverse, right-angled, with incomplete lateral sutures disappearing in posterior third, narrow median longitudinal white band, with four paramedial setae forming two rows that diverge toward front. Clypeus broad, flattened, smooth. Labrum transverse, semicircular at anterior margin, and with long semiadherent setae. Prosternum in anterior half with sparse uneven setaceous hairs.

Pronotum transverse, slightly convex, with width at base 3.0 times length; widely and almost imperceptibly emarginate at anterior margin with sparse, at base dense short setaceous hairs forming two transverse bands interrupted medially (especially on posterior margin). Pronotal shield not bound laterally, indistinct. Thoracic legs slender, with long pointed and slightly sclerotized claws.

Abdomen with parallel sides or narrows slightly toward tip. Dorsal locomotory ampullae convex and shagreen, divided by three transverse grooves which converge laterally at an acute angle and bind two transverse carinae directed laterally; of these carinae, anterior one 0.66 to 0.50 length of posterior one. Ventral locomotory ampullae divided by system of grooves which diverge inwardly into series of transversely elongate and somewhat oblique granules. Posterior margin of abdominal tergite IX produced tubercularly, with sclerotized spine. Body white. Head yellow with rusty tinge. Mandibles brownish-black. Anterior margin and sides of pronotum yellow. Tubercle at posterior margin of abdominal tergite IX with rusty tone. Body length 25 to 35 mm.

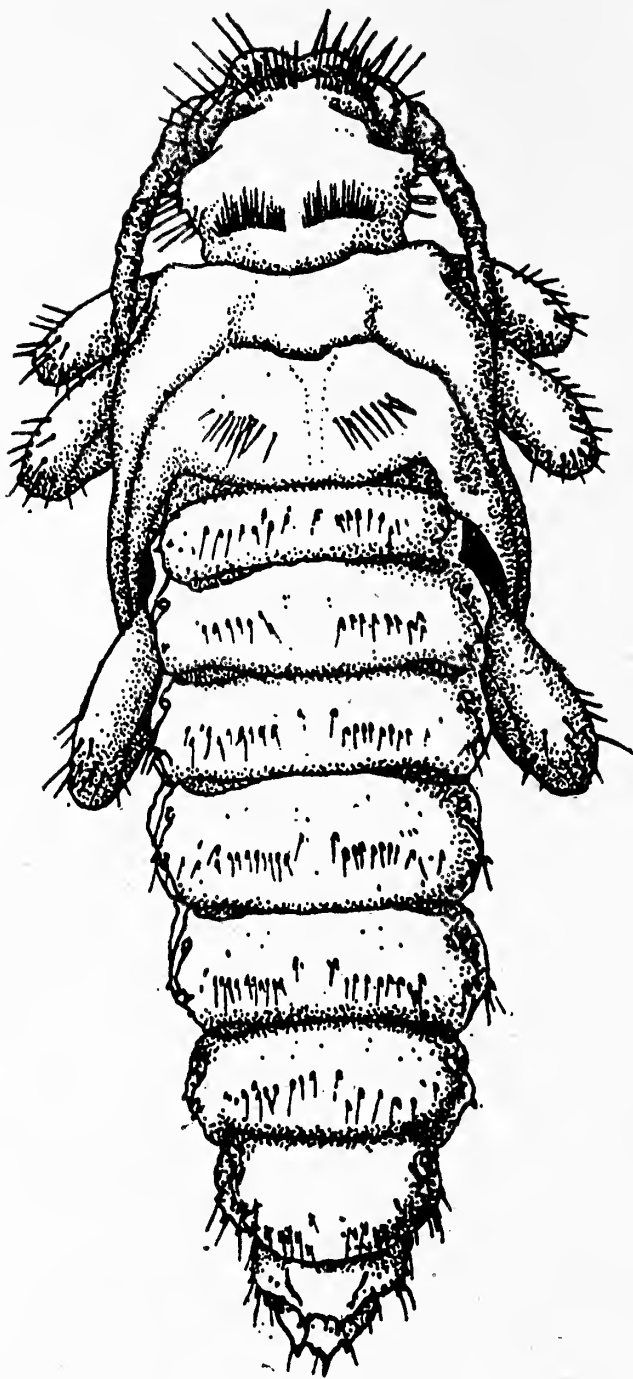
Pupa (Figure 31): Well distinguished by lateral tubercular prominences covered with sharp setaceous spinules. Body stocky, slightly elongate. Head moderately bent under. Frons broadly impressed in front and behind antennae, transversely convex between bases of antennae; with three or four lateral acicular setae at base of clypeus, pair of thin setae at bottom of anterior impression, and three or four setae at base of antennae. Antennae short, with apices reaching only up to midfemora.

Pronotum slightly convex on disk, transversely impressed at apex and before base, tubercularly produced laterally, with raised anterior margin on which long thin setae form transverse row interrupted medially, with bulging carinate posterior margin on which dense thick setae form transverse band interrupted in form of brushes. Metanotum laterally from midline with two transverse prominences covered with long acicular setae.

Abdomen narrows gradually toward tip or steeply in posterior half. Abdominal tergites convex, in posterior half with short pointed setaceous spinules. Tergites VII to VIII with larger spinules, some located in anterior half. Tip of abdomen produced, with long terminal spine directed downward. Abdominal sternites laterally with tubercular prominences covered with sharp setaceous spinules. Valvifers of female large, slightly elongate laterally (ventral view). Body length 20 to 28 mm, width of abdomen 8.0 mm.

Material: Collected in forests in Ob' region, Salair, Altai, and Yenisey region. Adult insects 303, larvae 126, and pupae five.

Distribution: West and eastern Europe, western Siberia to Yenisey inclusive. Found in large numbers in forests of Upper Ob' region.



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Figure 31. Pupa of *Rhagium mordax* (Deg.).

Biology: Inhabits mainly deciduous vegetation. Rarely seen in mixed forests. Flight of beetles from end of May through August. Feed in gardens on bark of tender branches and green leaves of willow, linden, birch, and aspen. Sighted in nature on plants of Umbelliferae. After mating female lays eggs in bark crevices on stumps and felled trees. One female can lay about 100 eggs. Ovaries of one female caught on June 24 contained 83 eggs. In 1968 the first batch of eggs was found in Salair forests on June 5th. Maximum number of eggs found in second half of June and early July. Incubation period in nature varies from 15 to 24 days, average 19.8 ± 0.1 . Earliest larvae detected on June 27. En masse hatching of larvae observed in last 20 days of July. Thus in 1969, in gardens under a gently sloping forest in Salair, 232 (66.9%)

of 347 larvae hatched in first 10 days of July, and 109 (31.4%) in middle 10 days. Oviposition was minimal in August and did not influence the larval population significantly.

Larvae live under bark, make longitudinal, meandering, and sometimes platformlike galleries, and plug them with bark frass. Galleries are made mainly in lower trunk zone of dead trees and stumps, or on that side of fallen dead trees next to the ground. Often seen on shoots of large roots. If a fungal mold has occurred under the bark, larvae penetrate the bark and make their galleries there. They never bore into the wood.

Before pupation larvae make a pupal cell under bark, which is impressed on alburnum, and filled with frass. Length of pupal cell 20 to 30 mm, width 14 to 16 mm. Pupation commences in July and ends in early August. Young beetles appear in August. Beetles hibernate and commence reproduction in the following spring. In forests of Ob' region in the Novosibirsk reserve zone, young beetles in pupal cells were found in the first half of August.

Weight of larvae before pupation ranges from 370 to 680 mg, pupae 229.4 to 480.0 mg, and beetles 137 to 309 mg. Weight of some larvae before the prepupal phase rises up to 700 to 830 mg and drops considerably during the prepupal phase. This black-spotted beetle lives in stumps and the root zone of decaying and dead fallen birch, willow, bird-cherry; and other deciduous species. In 1975 I found a large number on stumps of fir and maple in Altai. On one maple stump 34 cm in diameter 16 mature larvae were recovered from under bark. Larvae live under bark at the root base.

3. *Rhagium sycophanta* (Schr.)

Schrank, 1781, *Enumeratio insectorum Austriae indigenorum*, p. 137 (*Cerambyx*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 135-136.

Adult (Figure 32): Characterized by very long temples, tubercles at elytral bases, and other features. Body large. Head elongate, with dense punctation and adherent grayish-yellow hairs; temples behind eyes long, project sharply backward, with uneven punctation and sparse hairs. Apices of antennae barely reach pronotal base; first five segments with long dense adherent hairs, distal segments with short semierect hairs.

Pronotum at base and near anterior margin with transverse, flange bulging disk, laterally produced into conically pointed tubercles directed upward; with uneven rugose punctation, smooth median longitudinal striae, and adherent grayish-yellow hairs. Scutellum large, triangular, with dense hairs. Elytra elongate, narrow somewhat from humeri to apex, generally rounded basally, with longitudinal ridges on disk, rugose punctation and variegated yellowish-gray pubescence, at base medially
85 with distinct tubercles, alongside which distinct fossae or dents visible. Length of body 18 to 25 mm.

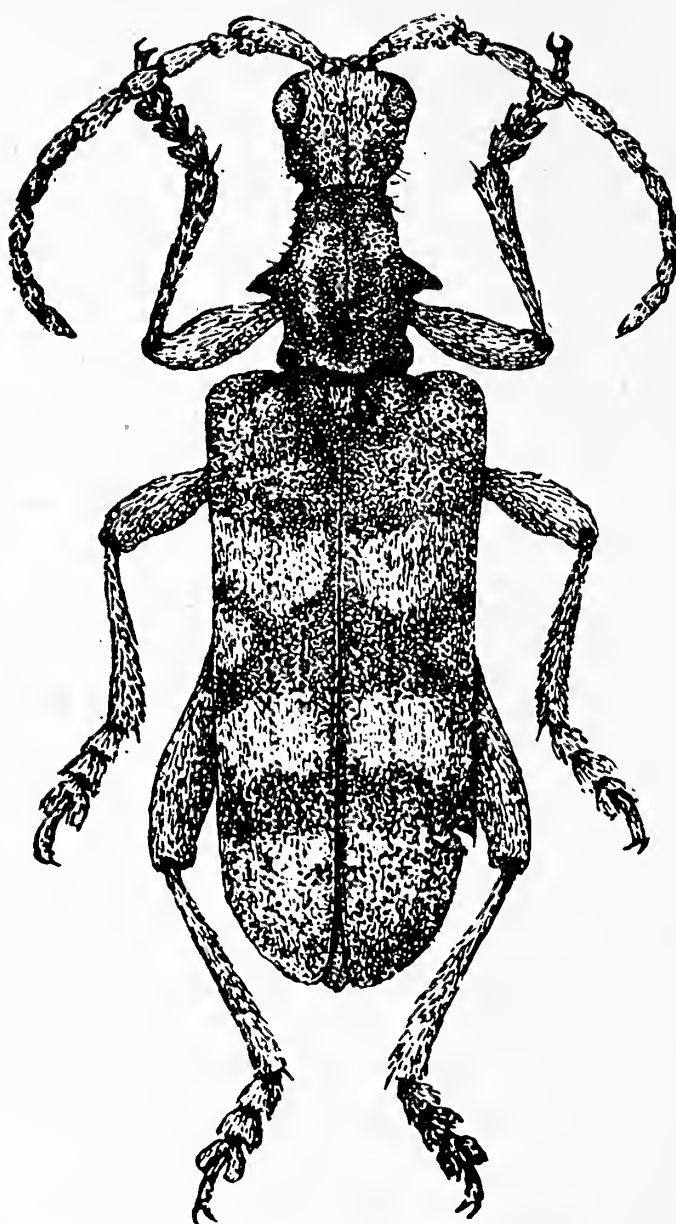


Figure 32. *Rhagium sycophanta* (Schr.).

Larva: Similar to larva of *Rhagium mordax* Deg. Differs in absence of spine on posterior margin of abdominal tergite IX. Body elongate. Head comparatively flat, narrows more toward apex. Epistoma smooth along anterior margin, with stray setaceous hairs that do not form tufts. Hypostoma transversely convex, in anterior half along sides of longitudinal white band with long hairs (in alveolar pores). Parietals (lateral view) in anterior half with deep pubescent pores. Pronotum transverse and flat; pronotal shield indistinct. Posterior margin of abdominal tergite IX angularly produced, more sclerotized at this site (yellowish tone) but without spinule. Body length of mature larva 20 to 29 mm.

Material: I did not find this species in nature but have described it from material in the Zoological Institute, Academy of Sciences, USSR (Leningrad).

Distribution: West and eastern Europe, western Siberia to Altai and Tomsk. Very rare in western Siberia.

Biology: Inhabits deciduous vegetation. Ecologically associated with oak, birch, and other wood species (Greze, 1936; Plavil'shchikov, 1936; Demelt, 1954).

2. Genus *Rhamnusium* Latr.

Latreille, 1829. In Cuvier's *Régn. Anim.*, 2nd ed., *Ins.*, vol. 2, p. 130; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 145-147; Mamaev and Danilevskii, 1975, *Lichinki zhukov-drovosekov*, pp. 115-119.

Adult: Characterized by elongate body, well-developed temples, long prosternal process extending beyond forecoxae, and elytra smooth, without longitudinal ridges.

Larva: Well distinguished from larvae of proximate genera in markedly developed coriaceous and setaceous urogomphi at tip of abdomen.

Members of the genus *Rhamnusium* are not seen east of the Urals. Of the six species distributed in Europe, only one (*Rhamnusium gracilicorne* Théry) is found in the southern Urals.

Type species: *Cerambyx bicolor* Schrank, 1781.

1. *Rhamnusium gracilicorne* Théry

Théry, 1894, *Bull. Soc. Entom.*, p. 265; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 150-152; Romadina, 1954, *Trudy Zool. In-ta AN SSSR*, vol. 16, pp. 216-218.

86 *Adult:* Head behind temples with deep cervix, median longitudinal groove between antennae, and markedly projecting temples. Eyes emarginate on inner side, slightly convex. Antennae barely cross elytral base, matte from 5th segment; inner side of 1st segment slightly emarginate, 5th segment as long as 3rd or slightly longer.

Pronotum almost equal in length to width at base, laterally with produced, slightly obtuse tubercles, anteriorly with large flange, basally with distinct transverse groove, disk smooth and lustrous, and with or without sparse indistinct punctation. Elytra with parallel sides (female) or narrows slightly toward apex (male), with dense rugose punctation, apically with broadly rounded outer and narrowly rounded inner angle, with faint longitudinal striae on disk. Hind femora reach only hind clivus of elytra, notably shorter than tibiae. First segment of hind tarsi slightly longer than next two segments together. Body yellowish-red; meso- and metathorax black; elytra dark blue with metallic sheen, epipleura in anterior half yellowish-red, second half of antennae dark brown (f. *typica*). Rarely, elytra yellow with reddish tinge (var. *rufotestaceum* Pic). Length 14 to 21 mm.

Larva (Figure 33): Readily distinguished from larvae of other Stenocorini in presence of long coriaceous conical process on tip of

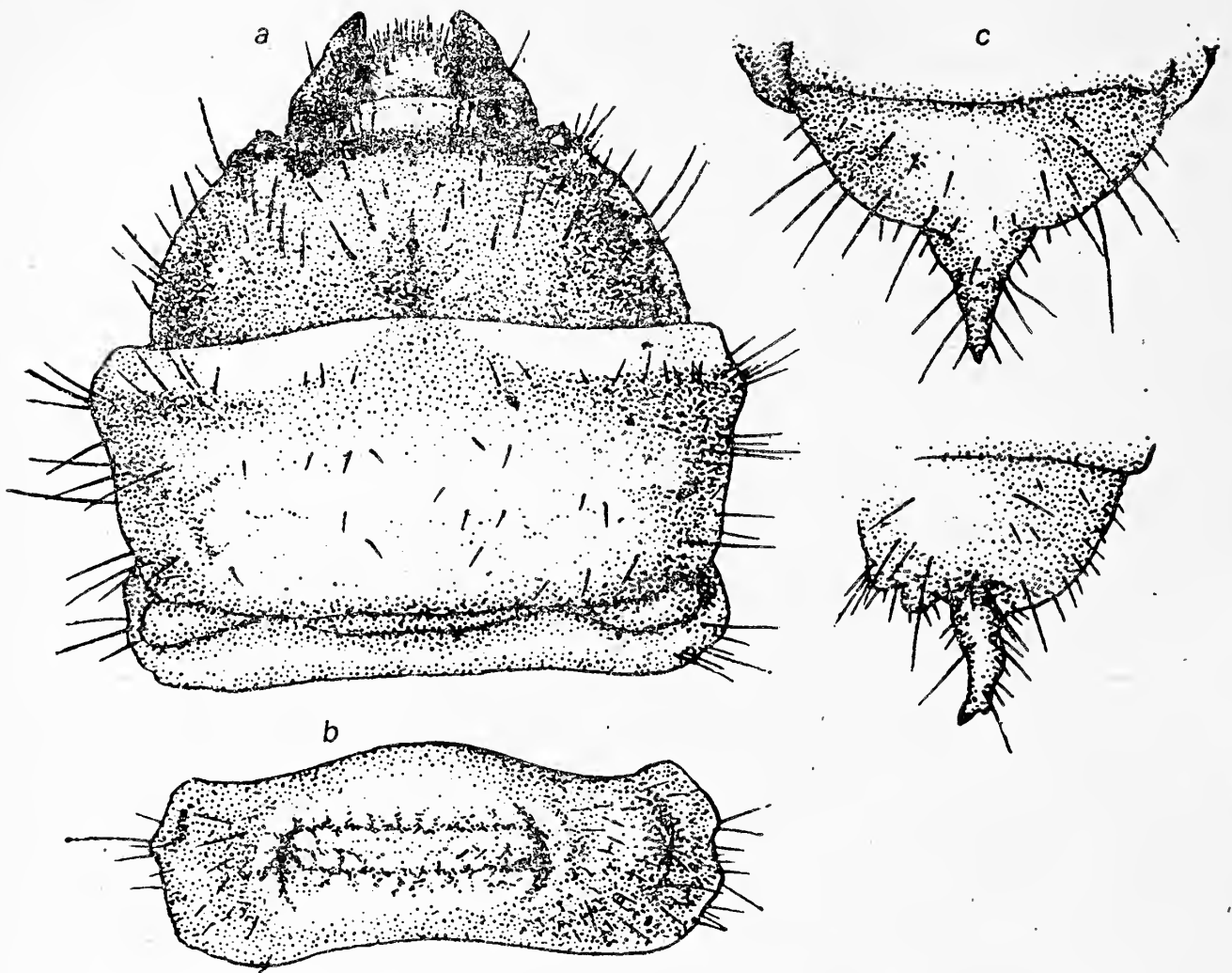


Figure 33. Larva of *Rhamnusium gracilicorne* Thêry.
a—head and pronotum; b—abdominal tergite with locomotory
ampulla; c—tip of abdomen (dorsal and lateral views).

abdomen. Head flat and transverse, insignificantly retracted into prothorax. Epistoma triangular, pointed backward, broadly compressed, with setae on anterior margin forming four tufts (one each laterally in region of notches and one small near each posterior clypeal angle); disk with
87 short setae widely separated in pairs. Frontal sutures wholly distinct, medial suture dark brown but white anterior to middle, somewhat indistinct. Hypostoma narrows in front, trapezoidal, with uneven setae in anterior half and distinct tentorial pits at base. Parietals in anterior half with long setaceous hairs; eyes hyaline, close to base of antennae. Clypeus large, broad, trapezoidal, with rusty border at base. Labrum transversely oval, with long dense rusty setae on anterior margin. Mandibles massive and thick, obliquely truncate at apex, with projecting lower denticle, transverse longitudinally striate band on outer side, and faint longitudinal carinae on inner side.

Pronotum transverse, with sparse setaceous hairs laterally. Pronotal shield convex, slightly striate, without noticeable lateral longitudinal grooves. Propresternum and presternum of prothorax with sparse thick

setae; eusternum triangularly convex, sclerotized in posterior half. Pro- and metanota in anterior half distinctly sclerotized, with minute rusty spinules. Thoracic legs well developed, with acute spinescent claws.

Abdomen thick; abdominal tergites bulge, with sparse coarse setaceous hairs on sides. Locomotory ampullae well developed on abdominal segments I to VII. Dorsal locomotory ampullae coriaceous, slightly granulate (granules form four indistinct rows), divided by two transverse grooves laterally joined with longitudinal grooves. Ventral locomotory ampullae with two rows of granules, divided by deep transverse groove; minute dense spinules in anterior half form transverse groove at base of front row of granules. Abdominal tergite IX with long conical coriaceous and setaceous process; perceptible sclerotized spinule at posterior margin, and dorsal to it minute coriaceous projection. Length of body 22 mm, width of head 4.5 mm.

Pupa: From exuviae collected from pupal cells it was established that the body is comparatively elongate and the abdominal tergites have very minute spinules arranged in transverse band. Tip of abdomen with pair of small, widely separated sclerotized tubercles.

Material: Collected in broad-leaved forests of the southern Urals. Larvae 19, larval and pupal exuviae from cells one each. Several beetles in collection of the Zoological Institute, Academy of Sciences, USSR were studied.

Distribution: West and eastern Europe. This species is distributed eastward up to the southern Urals inclusive.

Biology: Found in deciduous forests. Flight of beetles in first half of summer. Colonizes mainly elm; I did not find it on other species of trees. Larvae live in moist rotten wood, usually in cracks of thick branches of viable trees from which resin is oozing. Diameter of branches colonized by larvae mainly 8.0 to 14.0 cm. Galleries made by larvae in wood meandering, irregular, often intersect each other. As a result of larval activity, wood at base of branches so severely damaged it becomes a claylike pulp. The selfsame tree is colonized repeatedly. Hence larvae of different generations are often found simultaneously on the same tree. Mature larvae make galleries 8.0 to 14.0 mm wide, and pupal cell in upper layer of wood across shoot. Length of pupal cell up to 3.5 cm, width 1.5 cm. Weight of II-instar larva 173 to 396 mg, of III-instar up to 659 mg. Life cycle completed in two, perhaps three years.

3. Genus *Toxotus* Zett.

Zetterstedt, 1828, *Fauna Ins. Lapp.*, p. 374; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 154.

Adult: Characterized by antennae attached between eyes; pronotum

laterally with markedly produced spinescent tubercle; and 1st segment of hind tarsi notably longer than next two segments together.

Larva: Body thick. Head convex, in no case flat. Locomotory ampullae with granules. Abdominal tergite IX at posterior margin with pair of tubercular sclerotized spinules.

This genus consists of two species inhabiting the Palearctic. One is found in western Siberia.

Type species: Cerambyx cursor Linnaeus, 1758.

1. *Toxotus cursor* (L.)

Linnaeus, 1758, *Syst. Nat.*, 10th ed., p. 398 (*Cerambyx*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 154-157; Demelt, 1966, *Die Tierwelt Deutsch.*, vol. 2, p. 34.

Adult (Figure 34): Body large. Head narrow, with small cervix behind temples, fine dense punctation, short adherent yellowish hairs, deep median longitudinal suture, and at base of antennae on inner side with tubercular, usually rusty projection. Antennae slender, with apices reaching beyond 0.50 or 0.66 length of elytra. Eyes finely faceted, inner side more or less emarginate.

Pronotum anteriorly with distinct flange, at base with narrow transverse groove, narrowly rounded at raised anterior margin, with deep median longitudinal groove, on disk with paramedial longitudinal prominence directed laterally at ends, laterally with large spinescent tubercle; with minute dense punctation, yellowish, sometimes dense adherent hairs, and at base of longitudinal groove with smooth line. Scutellum triangular, pointed at apex, with fine dense punctation and dense golden pubescence.

Elytra elongate, narrow moderately toward apex, with produced spinescent inner angles apically, and projecting humeral tubercles; two longitudinal ridges on disk, fine dense rugose punctation, dense golden-yellow hairs, of which some (in area of suture) adhere to sides of suture and behind, and others (in lateral area) set away from sides and toward suture form vertical longitudinal stripes. Legs slender, comparatively long; 1st segment of hind tarsi notably longer than next two; 3rd segment bifurcate almost up to base. Abdomen convex; abdominal sternites with dense pubescence. Body black, antennae rusty. Elytra dark brown, almost black, laterally and medially on disk with two rusty bands. Length 23 to 32 mm.

Larva (Figure 35): Body thick and massive. Parietals rounded, convex, only in epistomal region with median longitudinal impression. Epistoma triangular, bound laterally by distinct frontal sutures joined by transverse white line. Longitudinal suture continuous, in form of dark brown line extending from apex to anterior margin of epistoma.

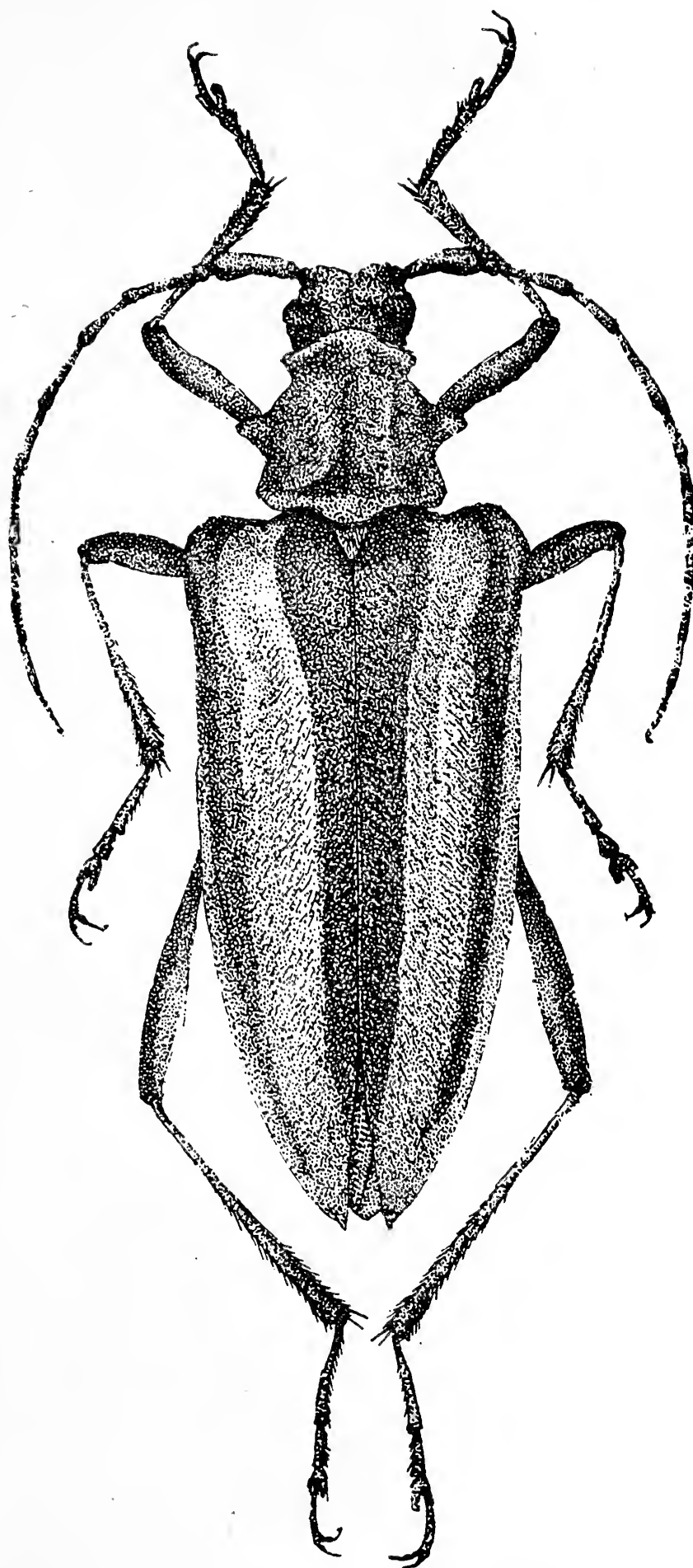


Figure 34. *Toxotus cursor* (L.).

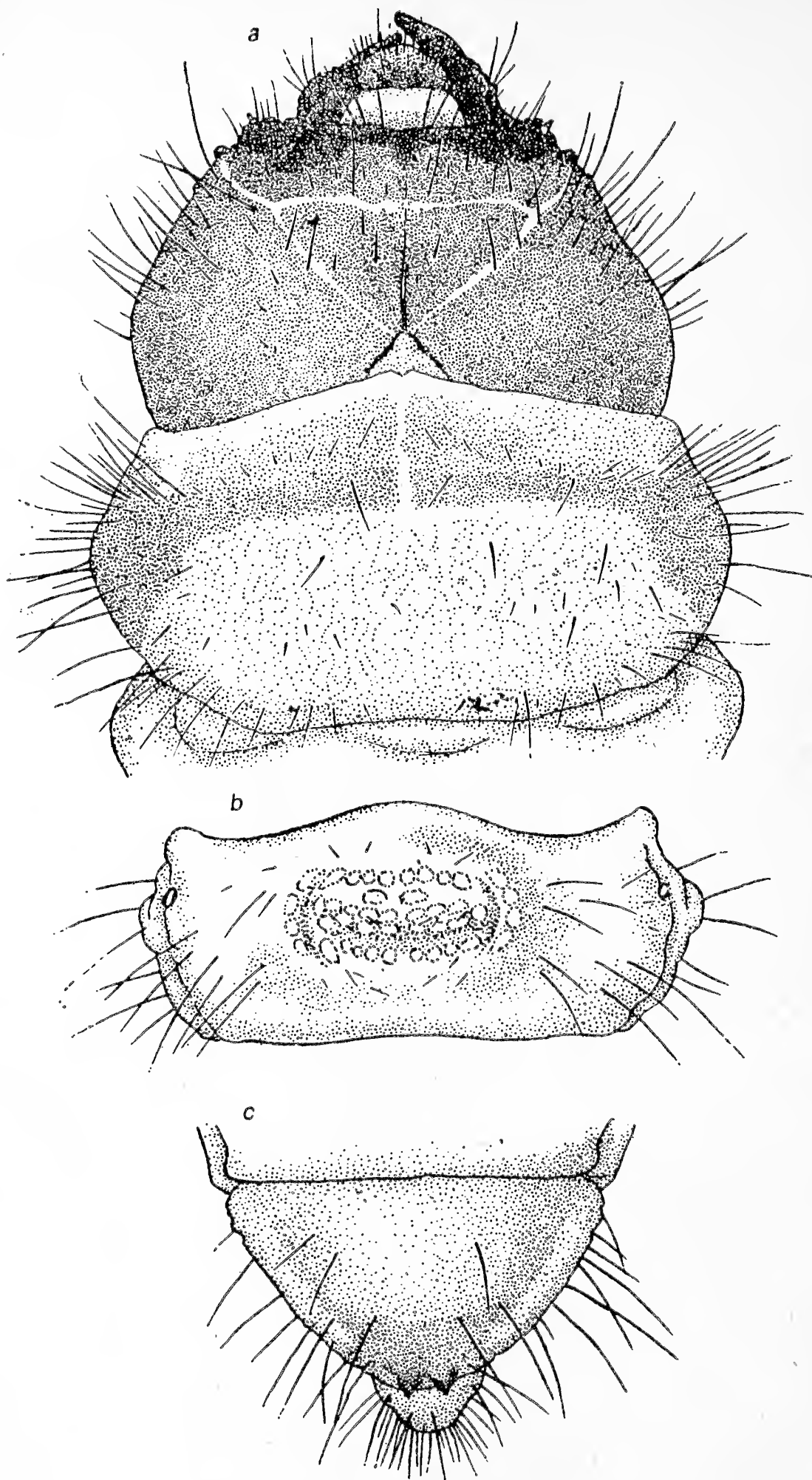


Figure 35. Larva of *Toxotus cursor* (L.).
a—head and pronotum; b—abdominal tergite
with locomotory ampulla; c—tip of abdomen.

Hypostoma narrows somewhat in front, medially divided by narrow white band, with numerous setae. Clypeus trapezoidal, convex, smooth, reddish brown at base. Labrum lustrous, convex, reddish-rust; anterior margin with short setae. Mandibles massive, truncate at apex.

Pronotum slightly convex; anterior half laterally with long hairs forming transverse band and hairs at base forming transverse row. Pronotal shield slightly convex, without lateral longitudinal fold, white, with slightly projecting striation, and stray setae on anterior margin. Prosternum with sparse long setaceous hairs. Eusternum bulges, coriaceous, narrowly rounded anteriorly. Thoracic legs slender, short, rusty. Claws minute, acicular.

Abdomen thick, laterally with sparse rusty hairs. Dorsal locomotory ampullae bulge and transversely elongate, with four rows of granules forming two more or less distinct ellipses, of which inner one more compressed, outer broader and surrounded by sparse setae. Ventral locomotory ampullae with two rows of granules and paired or unpaired setae along anterior and posterior margins. Abdominal tergite IX triangular, convex on disk, with four long hairs forming two transverse rows in anterior and posterior half, terminally with two contiguous, obtuse, tubercular, sclerotized spinules.

Body white, head reddish-rust. Sides of pronotum and anterior half rusty. Length of body 30 to 35 mm, width of head 4.5 to 5.5 mm.

Material: Collected in Ob' region (Barnaul). Rare. Two adult insects. Two larvae obtained from Moscow State University.

Distribution: Europe from the Atlantic Ocean, western Siberia to Altai.

Biology: Inhabits coniferous forests. Flight of beetles from end of May through July. Larvae live in rotten wood of spruce and pine lying on ground.

4. Genus *Stenocorus* F.

Fabricius, 1775, *Syst. Entom.*, p. 178; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 158-161; Gressit, 1951, *Longicorn Beetles of China*, vol. 2, pp. 56-57 (*Toxotus*).

Adult: Body comparatively large and elongate. Antennae shorter than body, reach beyond 0.50 (female) or 0.66 (male) length of elytra. Frons between antennae transversely convex. Pronotum with developed rather small tubercles laterally, with broad flange along anterior margin, and transverse, sometimes sharp, groove at base.

Larva: Thoracic legs well developed, tip of abdomen with spine.

Pupa: Body somewhat curved. Pronotum with transverse striation, narrows markedly in front, and laterally with produced tubercle. Meta-

notum and first four abdominal tergites with large tubercular prominences densely covered with setaceous hairs.

Not more than four species are known in northern Asia, of which one [*Stenocorus amurensis* (Kr.)] is found in the Far East, and the remaining three in southwest regions of western Siberia, mainly in southern Altai and spreading toward mountain landscapes in Central Asia. Species of this genus are ecologically associated with deciduous vegetation. Larvae live in and near roots, pupate in soil.

Type species: Leptura meridianus Linnaeus, 1758.

KEY TO SPECIES

Adult Insects

- 1 (6). Antennal segments usually cylindrical, not flattened, and not produced apically; 4th segment 2.0 to 4.0 times longer than 2nd.
- 2 (5). Elytra notched at apex, with sharp outer angle. Fourth antennal segment 3.0 to 4.0 times longer than 2nd.
- 3 (4). Frons between antennae markedly convex transversely. Base of antennae posteriorly deeply impressed. Fourth antennal segment equal to 10th. 1. *S. amurensis* (Kr.).
- 4 (3). Frons between antennae slightly convex. Base of antennae barely impressed posteriorly. Fourth antennal segment distinctly shorter than 10th. 2. *S. meridianus* (L.).
- 5 (2). Elytra not notched apically, slightly obtuse here, with obtuse outer angle. Fourth antennal segment 2.0 times longer than 2nd, considerably shorter than 10th. 3. *S. vittatus* (Fisch.-Waldh.).
- 6 (1). Antennal segments thick, notably flattened, and somewhat produced apically; 4th antennal segment slightly longer than 2nd, 0.50 length of 10th. 4. *S. tataricus* (Gehl.).

Larvae

- 1 (2). Pronotal shield with anterior margin medially produced angularly, even, without smooth white spots, and entirely covered with minute spinules. 1. *S. amurensis* (Kr.).
- 2 (1). Pronotal shield not medially produced along anterior margin, digitate, with smooth white spots, and without spinules. 2. *S. meridianus* (L.).

1. *Stenocorus amurensis* (Kr.)

Kraatz, 1879, *Deutsch. Entom. Z.*, vol. 23, p. 100 (*Toxotus*): Reitter,

1913, *Berl. Entom. Z.*, p. 181 (*Stenocorus lepturoides*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 163-164; Cherepanov and Cherepanova, 1975, *Zhuki-drovoseki lesov*, pp. 36-40.

Adult (Figure 36): Body large, elongate, thick in females. Head elongate, narrows markedly behind eyes. Frons in anterior half and behind antennal base broadly impressed, raised along anterior margin,

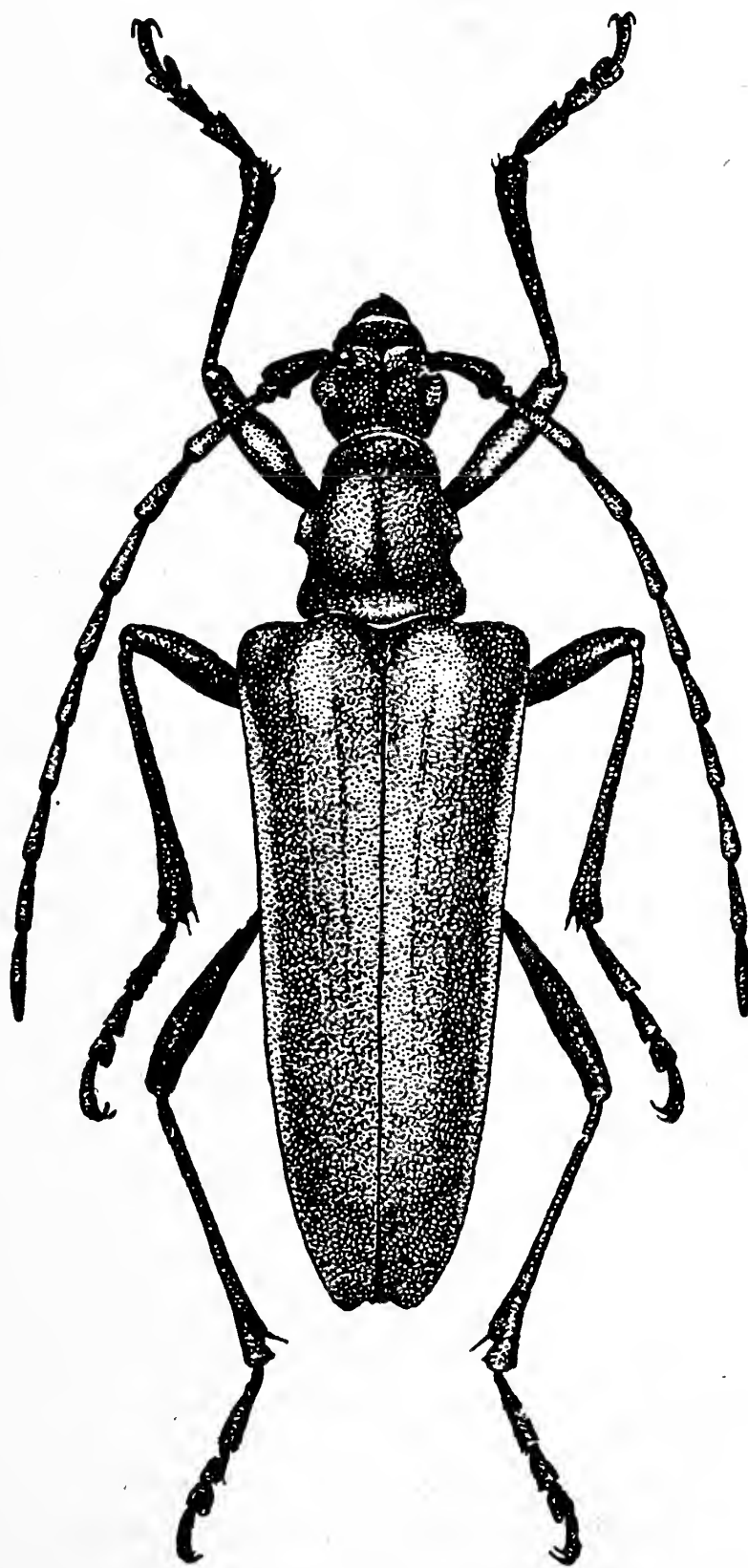


Figure 36. *Stenocorus amurensis* (Kr.), female.

transversely convex between antennae; with dense punctation and medially with narrow smooth suture. Eyes bulge, finely faceted, slightly emarginate on inner side. Antennal bases proximate, shifted toward
 92 middle of frons; antennal apices in female extend beyond 0.50, in male beyond 0.66 length of elytra; antennae with fine dense punctation and gray adherent hairs. Third antennal segment 1.5 times longer than 4th, but shorter than 4th and 5th segments together.

Pronotum elongate, insignificantly convex on disk, distinctly wider posteriorly than anteriorly, laterally produced tubercularly, posteriorly with narrow-grooved, anteriorly wide-grooved flange; disk with narrow median longitudinal groove, fine dense punctation and gray wavy, closely adherent hair cover. Scutellum triangular, angularly rounded apically. Elytra elongate, broaden at humeri, narrow moderately toward apex in female, markedly in male, with two longitudinal ridges; apically truncate, with inner angle produced, spinescent. Legs long; hind tibiae slender and longer than tarsi. First tarsal segment distinctly longer than 2nd and 3rd together.

Abdomen thick, narrows gradually toward apex in female, elongate and slender in male. Body, antennae, elytra, legs, and abdomen entirely black in female, sometimes with rusty tinge. In male head, thorax, and legs black; inner side of femora often rusty; antennae dark brown, sometimes light rust apically; abdomen reddish-rust; and elytra light rust, darkening along suture and laterally. Length of body 18 to 25 mm.

Egg: White, elongate, obtusely rounded at poles, with fine sculpture. Length 2.0 mm, width 0.6 mm.

Larva (Figure 37): Readily distinguished from other species by spinules on locomotory ampullae and spine at tip of abdomen. Lives in roots of deciduous trees. Body large, moderately elongate. Head flat, narrowly rounded anteriorly, and half retracted into prothorax. Epistoma triangular, bound by sharp white frontal sutures; anterior half with transverse white band, medially divided by dark brown longitudinal line (sutura medialis). Hypostoma transverse, narrows somewhat anteriorly, and medially divided by longitudinal white band. Clypeus broad,
 93 convex, smooth; in anterior half (close to apex) sometimes with perceptible groove, and with prominent transverse band. Labrum broad, convex in anterior half, with angularly rounded anterior margin, and with long setae. Mandibles massive, elongate, obliquely truncate at apex. Prothorax transverse, with very sparse long setae ventrally in anterior half.

Pronotum 2.5 times wider than long, slopes slightly toward head, and not coarsely striate; anterior margin glabrous in middle; sparse setaceous hairs along sides from jumbled transverse row, dense hairs at posterior angles form short transverse stripe. Pronotal shield not

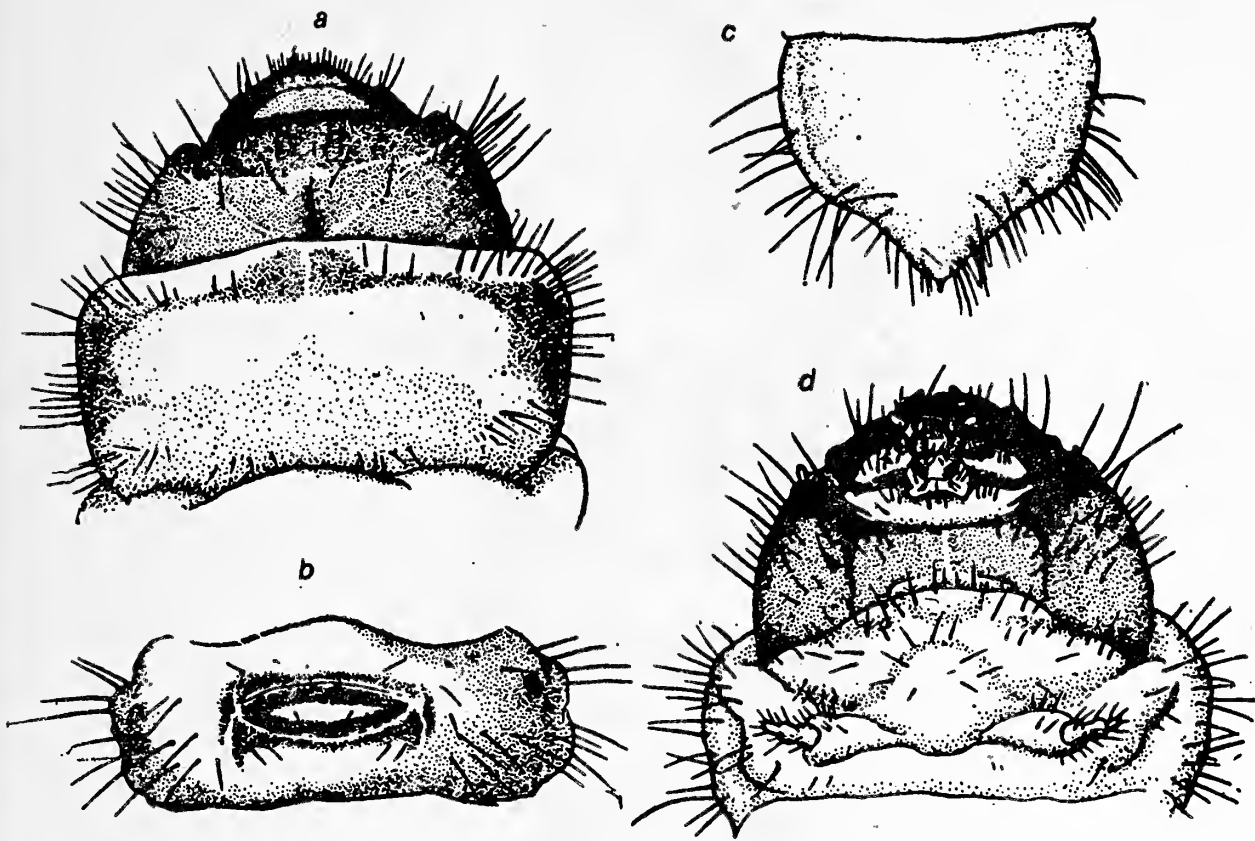


Figure 37. Larva of *Stenocorus amurensis* (Kr.).

a—head and pronotum; b—abdominal tergite with locomotory ampulla; c—tip of abdomen; d—head and prosternum.

delimited laterally and just slightly shagreen. Thoracic legs well developed, inner side with long setaceous hairs, with long sharp claw apically.

Abdomen elongate, narrows gradually toward tip. Dorsal locomotory ampullae convex, divided by shallow median longitudinal groove and two narrow deep transverse grooves that join laterally and directly with longitudinal folds; with minute sharp spinules visible only under high magnification. Ventral locomotory ampullae divided by deep transverse groove that joins laterally with short longitudinal folds; with dense minute spinules. Posterior margin of abdominal tergite IX (lateral view) with small sclerotized spinule. Body white. Head reddish-rust. Pronotum laterally and on anterior margin rusty; middle colored section projects forward markedly. Body length up to 30 mm, width of head 4.0 mm.

Pupa (Figure 38): Well distinguished by transverse striation on dorsal side of thorax and tubercular fibrous prominences on metanotum and abdominal tergites I to IV. Body massive, slightly curved. Head 94 elongate, markedly bent under. Frons between antennae transversely convex. Antennae bent behind midfemora, annular.

Pronotum elongate, considerably narrower at anterior end than at posterior, transversely striate, laterally produced tubercularly, with dense transverse pubescent band at base. Meso- and metanota on disk

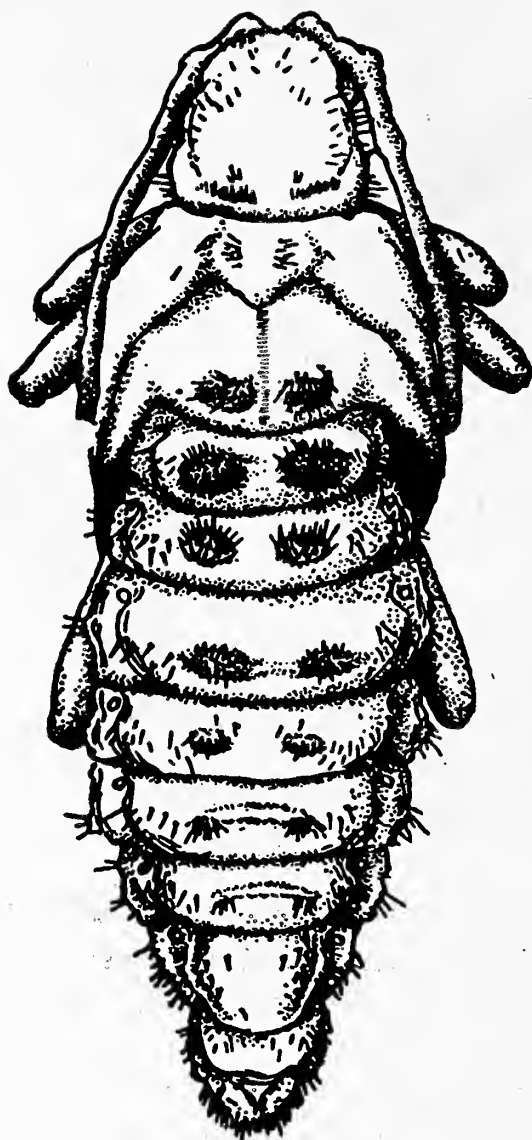


Figure 38. Pupa of *Stenocorus amurensis* (Kr.).

with transverse parallel striation. Metanotum with pair of tubercular pubescent prominences. Hind femora directed dorsally.

Abdomen moderately elongate, narrows toward tip, and here with dense hair cover and produced like a mastoid. Disk of abdominal tergites I to IV with two tubercular densely pubescent prominences each. Tip of abdomen (ventral view) obtuse, with angular carina. Valvifers of female well developed, conical, directed laterally. Length of body 16 to 20 mm. Maximum width of abdomen up to 6.0 mm.

Taxonomic remarks: Color of abdomen and elytra comparatively stable in male, but sometimes specimens with black abdomen and elytra blackened along suture and laterally also seen. These specimens are identical to *Stenocorus lepturoides* Reitt., described from a single male specimen. The latter should evidently be placed in this species as an aberrant form (ab. *lepturoides* Reitt.).

Material: Collected in Ussuri-Primor'e region and Sakhalin. Adult insects 159, larvae 50, pupae eight.

Distribution: Amur basin, roughly from Zeya River, Sakhalin; north-east China, Korea. I found large numbers in broad-leaved forests in the region of Komarovka and Artemovka Rivers.

Biology: Inhabits mainly low-lying forests in river catchments and banks of river terraces. Flight of beetles observed from latter half of June through August. Beetles maximum in first half of July. For example, in 1972 systematic collection in the first few days of June through July 25 yielded: 10 specimens—second half of June, 67—first half of July, and four—second half of July. Beetles visit flowers to collect pollen, often seen on trees. After mating, female lays eggs in soil and on roots of dead trees. Willow, bird-cherry, maple, elm, oak, walnut, Amur oak tree and other deciduous species are colonized. One female can lay a large number of eggs. Ovaries of one female dissected June 24 contained 260 eggs. Incubation period varied from 12 to 16 days at 16°C.

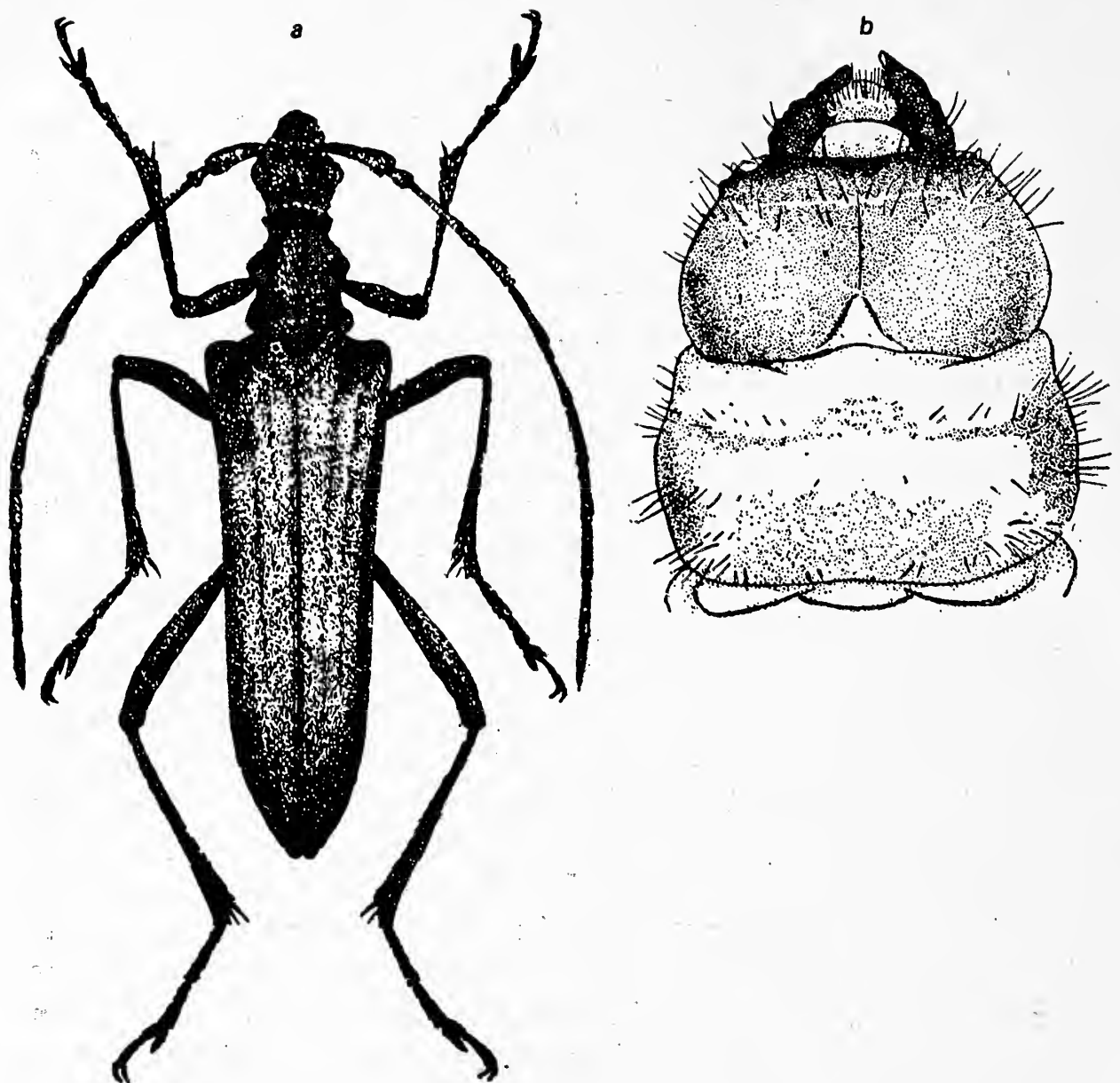
Larvae live under bark of thick and thin roots, make irregular longitudinal galleries, sometimes broader, sometimes narrower, and plug them with frass, leaving an outer layer of bark. Width of gallery under bark 10 to 20 mm. Before pupation, after third hibernation, larva abandons root, makes pupal cell in soil usually alongside root, and pupates in it. Pupal cells slightly elongate. Length of cell 25 mm, width 95 about 22 mm. Larvae pupate in May and first half of June. Pupae maximum during first few days of June. Five pupae found in catchment area of Komarovka River on May 31 in soil under bird-cherry. Larvae of last instar not found. Only II-instar larvae detected on roots. Pupae lie in cell with dorsal side up. At 10 to 14°C they require not less than three weeks for development. In the catchment area of Komarovka River in the Far East in 1973, the first beetles were sighted on June 19. Emergence of young beetles from pupae ceased in early July. Beetles emerged from cells onto soil surface in five to seven weeks. Weight of larvae before leaving roots for pupation 205 to 1,048 mg, of those ready for pupation in cell 151 to 734 mg, pupae 133 to 664 mg, and beetles 63.5 to 550.0 mg.

Stenocorus amurensis (Kr.) colonizes roots of stumps and dead trees; sometimes seen on dead roots of viable maple, elm, and oak. The same tree is colonized repeatedly. This species is found together with *Prionus insularis* Motsch., *Pidonia similis* (Kr.), and *P. amurensis* Pic.

2. *Stenocorus meridianus* (L.)

Linnaeus, 1758, *Syst. Nat.*, 10th ed., p. 398 (*Leptura*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 164–166; Gressitt, 1951, *Longicorn Beetles of China*, vol. 2, p. 58 (*Toxotus*).

Adult (Figure 39, a): Very similar to *Stenocorus amurensis* (Kr.). Differs in less impressed head behind antennal base, 1st antennal seg-



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Figure 39. *Stenocorus meridianus* (L.).

a—adult; b—larva.

ment thick and slightly emarginate on lower side. Head between eyes more even, with flat double punctation (small punctures visible between large ones), with narrow median longitudinal suture. Antennal apices extend beyond 0.75 (male) length of elytra.

Pronotum with minute punctation and adherent gray hairs; slightly elongate anteriorly and with deep flange, transverse groove basally, laterally produced into obtuse tubercles, and longitudinal smoothly grooved band in middle of posterior half.

Elytra produced, narrow from humeral tubercles toward apex; with dense punctation and minute adherent hairs; slightly notched apically, inner angle elongate and spinescent. Body black. Antennae rusty or dark brown; elytra black with rusty tinge at base; legs rusty-red, femora and tibiae black apically, tarsi darkened (f. *typica*); often elytra and legs

totally black (ab. *chrysogaster* Schr.); sometimes elytra black with light-colored band on disk and border on humeral tubercles (ab. *bilineatus* Pic). Abdomen black, sometimes totally red or only at tip. Color variable. Length of body 15 to 25 mm.

Egg: White, somewhat greenish, markedly elongate, with parallel sides, at one pole obtusely or broadly rounded, at other pointed. Chorion with fine barely perceptible, noncellular sculpture, causing matte appearance. Length 1.9, width 0.4 mm.

Larva (Figure 39, b): Readily distinguished from larva of *Stenocorus amurensis* (Kr.) by white spots on pronotal scutum. Body elongate. Head exteriorly narrows perceptibly. Epistoma triangular, rounded apically, in posterior half divided medially by distinct dark brown longitudinal suture, laterally bound by white straight frontal sutures, transverse white band anterior to middle interrupted at longitudinal suture, dark brown border on anterior margin, and darkens at anterior angles.

- 96 Hypostoma flat, somewhat narrows toward front, laterally with straight sutures, basally with narrow oblique tentorial pits and coarse setae forming tuft on each side. Temporo-parietal lobes laterally in anterior half with uneven setaceous hairs. Clypeus large, trapezoidal, narrows markedly in front, rusty at base and white in anterior half. Labrum white, broadly rounded in front, with dense long setae; basally narrows sharply and rusty here. Mandibles elongate, with transverse grooves at base; smooth in anterior half and obliquely truncate or slightly notched apically, with well-developed carina on inner side extending from lower denticle toward middle of upper margin.

Pronotum transverse, 2.5 times wider than long, with almost parallel sides, slightly convex on disk, with transverse rusty band in anterior half that broadens in middle and merges laterally with extensive rusty field; setaceous hairs in front of rusty band and laterally. Pronotal shield rusty, sclerotized, with minute dense spinules, digitate at anterior margin and not produced forward medially; with minute white spots [in *Stenocorus amurensis* (Kr.) anterior margin smooth, not digitate, and medially produced forward]. Presternum, proplesternum, and apex of eusternum with sparse setaceous hairs. Eusternum coriaceous, glabrous in posterior half. Legs comparatively well developed, long, with sparse setae and acicular claws.

- Abdomen laterally with long sparse hairs. Locomotory ampullae well developed on abdominal segments I to VI. Dorsal locomotory ampullae divided by two transverse grooves and thus appear to consist of three transverse carinae, and covered with minute tubercular spinules. Of these carinae, middle one medially with smooth transverse white
97 band and two setae on each side forming transverse row. Ventral locomotory ampullae covered with minute but distinctly visible spinules, and

medially divided by white transverse groove, with 10 to 15 setae on anterior margin, two to four setae on posterior margin. Sternite VII behind middle with coarse setaceous hairs forming transverse row, quite often with minute spinules here forming transverse band. Tergite IX posteriorly markedly produced conically, terminates in pointed sclerotized spine, and with setaceous hairs in posterior half. Larvae of I-instar flat, laterally with long acicular setae. Spine at tip of abdominal tergite IX lacking but appears in later stage. Body length of last-instar larva up to 34 mm, width of cephalic capsule up to 5.0 to 6.0 mm.

Material: Collected in the southern Urals in Chesnokovki region. Adult insects 67, larvae 27. Several larvae developed from eggs laid by beetles in the laboratory.

Distribution: Europe, Siberia up to Baikal. Found in large numbers in the southern Urals. Rare in western Siberia and east of the Urals; I did not find it there.

Biology: Inhabits deciduous vegetation; ecologically associated with oak, elm, and other deciduous species. Flight of beetles from mid-June up to August. I found them in large numbers in Krasnokhomsk forest reserve in the Urals from June 20 through July 20. Beetles feed on flowers of Umbelliferae, Rosaceae, and other plants. Female lays eggs in soil on the roots of thick-trunked trees and stumps. Ovaries of one female collected in nature on June 25 contained 282 eggs. Larval hatching commences two weeks after oviposition. Under laboratory conditions 89 eggs were maintained at $22.1 \pm 0.5^{\circ}\text{C}$, from which 64 larvae hatched in 11 to 14 days, and 25 in 15 to 17 days. Average incubation period 13.1 ± 0.2 days.

After hatching larvae move freely in the soil, bore into bark of roots, make longitudinal galleries, and plug them with frass. Gallery initially slightly, later deeply impressed in wood, and edge of gallery slopes. Larvae advance generally from base or from middle part of root toward apex, and very rarely from apex to base. Width of gallery made in wood initially 0.6 cm and terminally 1.2 to 2.1 cm. Length of gallery 49 to 68 cm. Colonizes roots 1.0 to 6.5 cm in diameter lying in soil at a depth of up to 17 to 50 cm. Weight of beetles emerging from soil ranges from 132 to 175 mg (male) and up to 257 to 270 mg (female).

3. *Stenocorus vittatus* (Fisch.-Waldh.)

Fischer-Waldheim, 1842, *Catalog. Coleopt. Sib.*, p. 19 (*Toxotus*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 172.

Adult: Readily distinguished by color of elytra and other features. Body moderately elongate. Head behind eyes uniformly and insignificantly elongate, with fine dense punctation. Frons between antennae sharply convex transversely. Antennal apices extend beyond 0.50 (female) or 0.75 length of elytra.

Pronotum barely longer than width at base, bulges on disk and with two tubercles; with minute uneven punctation; sharp flange near anterior margin, narrow transverse groove basally, and fully developed tubercle laterally; usually with dense rusty adherent pairs. Scutellum broadly triangular, with dense punctation and dense adherent hairs.

Elytra broaden at humeri, narrow toward apex; with fine punctation, basally without large punctation, with light-colored adherent hairs directed from suture to sides (forming light-colored longitudinal stripe laterally); apically truncate, with rounded inner and outer angles. Legs long and slender; hind femora barely reach apices of elytra. Body black. Antennae rusty, first two segments usually dark brown or black. Elytra straw-rust, with black longitudinal bands along suture and on sides; band close to suture broadens anteriorly. Length of body 14 to 20 mm.

Distribution: Kazakhstan, southern Altai.

Biology: Inhabits deciduous forests. Rare. I did not find it. Beetles commence flight in June.

4. *Stenocorus tataricus* (Gebler)

Gebler, 1841, *Buelet. Acad. Petersb.*, vol. 8, p. 375 (*Toxotus*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 176-177.

Adult: Similar to *Stenocorus meridianus* (L.) in body shape but differs in structure of antennae and other features. Body comparatively thick. Head behind eyes elongate, narrows posteriorly. Antennae in female barely extend beyond 0.50 elytra but in male almost reach apices of elytra; 3rd to 7th segments notably flat, with insignificantly produced outer angle.

Pronotum not longer than width at base (female) or only slightly longer (male), with well-developed tubercles on sides, sharp flange on anterior margin, deep transverse groove at base, minute dense punctation; convex on disk with short median longitudinal groove. Scutellum triangular, somewhat elongate, with dense punctation. Elytra narrow from humeri (male) or almost parallel (female); with indistinct minute punctation and dense adherent hairs; truncate apically, outer angle obtuse. Body, legs, antennae, and elytra black (f. *typica*). Sometimes body reddish-rust, head and pronotum black, or antennae, legs, and abdomen yellowish-rust; rarely elytra light rust with black band on suture. Length of body 14 to 26 mm.

Distribution: Southeast Kazakhstan and southwest Altai.

Biology: Flight of beetles observed in June and July. Evidently inhabits deciduous forests in mountain regions. Sighted along Lake Zaisan. Rare in Altai. I did not find it.

5. Genus *Pachyta* Zett.

Zetterstedt, 1828, *Fauna Ins. Lapp.*, vol. 1, p. 376; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 180-181; Gressit, 1951, *Longicorn Beetles of China*, vol. 2, pp. 58-59; Kojima and Hayashi, 1969, *Insect Life in Japan*, vol. 1, p. 10 (Longicorn Beetles); Linsley and Chemsak, 1972, *Cerambycidae of North America*, vol. 6, pp. 65-66.

Adult: Body large and stocky. Head moderately elongate, narrower than pronotum; eyes slightly emarginate; antennae attached in front of eyes. Pronotum produced into lateral conical tubercles, in anterior third broadly elongate. Elytra broaden at humeri, with projecting humeral tubercle. Hind tarsi slender, do not broaden; 1st segment longer than next two together, less than half of last segment notched.

Larva: Body of mature larva large, parietals round and broaden, narrow toward front. Pronotum in width 0.25 to 0.33 length; disk flat, glabrous, laterally with long hairs. Legs developed. Locomotory ampullae sclerotized, shagreen. Dorsal locomotory ampullae divided by transverse grooves into two transverse carinae, without granules. Posterior margin of abdominal tergite IX produced in form of small sharp sclerotized spine.

- 99 *Pupa*: Body somewhat recurved; head markedly bent under; antennae flexed to sides, with arcuate apices reaching beyond midfemora. Pronotum with broad sharp flange in anterior third, laterally produced, tubercular, and covered with setae. Adherent setae along anterior and posterior margins form transverse rows. Metanotum with pair of long knobby tubercles, densely covered with setae at apex. Tip of abdomen with small nonsclerotized spinule.

Larvae found in roots of coniferous trees. After third hibernation they emerge from roots and pupate in upper layer of soil.

The genus *Pachyta* is comparatively old and widely distributed in the Holarctic, but characteristically comprises few species. In the USSR three species are known, of which one inhabits forests of the Far East, another ranges from the Atlantic to Trans-Baikal (Shilka and Argun') inclusive, and the third inhabits most of Eurasia and North America.

Type species: *Leptura quadrimaculata* Linnaeus, 1758.

KEY TO SPECIES

Adult Insects

- 1 (4). Elytra straw-yellow, with sharp black spots. Pronotum with dense rugose punctation.
- 2 (3). Elytra broad, narrow slightly posteriorly, truncate apically, with

- black spots posteriorly slightly elongate. 1. **P. quadrimaculata** (L.).
- 3 (2). Elytra elongate, narrow markedly posteriorly, notched apically, with black spots posteriorly markedly longitudinally elongate. 2. **P. bicuneata** Motsch.
- 4 (1). Elytra monochromatic dark red or brownish-rust, without black spots; elytra of female straw-yellow, with oblique indistinct black band in anterior half and large elongate indistinct black spot in posterior half. Pronotum with minute punctation, not rugose. 3. **P. lamed** (L.).

Larvae

- 1 (4). Lower unpaired ocelli on head lacking. Abdominal tergite IX glabrous in anterior half, with stray hairs only sometimes close to sides.
- 2 (3). Anterior three and posterior two ocelli on parietals well developed, convex, hyaline. Abdominal tergite VIII in mature larvae transverse, usually wider than long, in any case not elongate. Found on pine roots (*Pinus sylvestris*). 1. **P. quadrimaculata** (L.).
- 3 (2). Anterior three ocelli on parietals well developed, with small projecting pigmented spots; posterior two ocelli faint or not visible. Abdominal tergite VIII in mature larvae elongate, longer than wide, in any case not transverse. Found on roots of Korean pine (*Pinus koraiensis*). 2. **P. bicuneata** Motsch.
- 4 (1). Lower unpaired ocellus on head distinctly visible as small white spot or convex hyaline tubercle. Abdominal tergite IX in anterior half not glabrous, with sparse hairs. Found on roots of spruce (*Picea obovata*). 3. **P. lamed** (L.).

Pupae

- 1 (4). Pronotal disk with coarse transverse striation.
- 2 (3). Hind femora with sparse long setae in distal third. 1. **P. quadrimaculata** (L.).
- 3 (2). Hind femora glabrous in distal third, only on apical margin with thin setae, of which one or two sometimes slightly shifted toward middle. 2. **P. bicuneata** Motsch.
- 4 (1). Pronotal disk smooth, without noticeable transverse coarse striation, sometimes with faint thin pattern on sides. 3. **P. lamed** (L.).

1. *Pachyta quadrimaculata* (L.)

Linnaeus, 1758, *Syst. Nat.*, 10th ed., p. 397 (*Leptura*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 183-185; Gressitt, 1951, *Longicorn Beetles of China*, vol. 2, p. 10; Demelt, 1966, *Die Tierwelt Deutsch.*, vol. 52 (Cerambycidae), pp. 36-37.

Adult (Figure 40): Readily distinguished from other species by four spots on elytra and coarse punctation on pronotum. Body large, broadens at shoulders. Head narrow, tapers gradually behind eyes, tubercularly convex at antennal bases, with median longitudinal suture, transversely compressed behind antennae and on vertex; with dense punctation and light-colored hairs that are sometimes dense. Antennal apices reach beyond anterior (female) or beyond posterior (male) spots on elytra, with short, very dense adherent hairs apically.

Pronotum not longer than width at base (female) or only slightly longer (male), with sharp conical tubercle laterally, broad deep flange anteriorly, transverse groove at base, and longitudinal, sometimes smooth median groove; disk paramedially tubercularly convex; with large dense punctation and sometimes comparatively dense light-colored hairs. Scutellum flat, elongate, triangular, and pointed at apex; with fine dense punctation and tender adherent hairs.

Elytra broad, with well-developed humeral tubercles and broad dent on inner side; basally with dense coarse punctation; apex truncate or slightly notched. Legs long, hind tarsi slender, 1st segment longer than next two together, 3rd segment bifurcate up to less than half its length. Body black. Elytra straw-yellow, with four large black spots (two per elytron); spots anterior to middle rounded, in posterior half often acutely extended anterolaterally. Anterior spots rarely absent (ab. *bimaculata* Schönh.) or join posterior spots along sides through longitudinal stripe (ab. *hubentali* Jänner). Readily distinguished from *Pachyta lamed* (L.) by more distinct (not diffuse) spots. Length of male and female 10 to 20 mm.

Egg: Elongate and rounded at poles, with minute deep cellular sculpture. Cells somewhat longitudinally elongate and spaces between them matte. Length 2.0 mm, width 0.6 mm.

Larva (Figure 41): Readily distinguished by structure of ocelli on head. Body moderately elongate. Head flat, round, and narrow in front. Epistoma rounded posteriorly, bound by sharp white frontal sutures, divided medially only in posterior half by longitudinal brownish suture (sutura medialis) and transverse white band, usually interrupted medially. Hypostoma smooth, flat, narrows slightly in front, with faint median longitudinal white striae, and four setae in transverse row. Clypeus trapezoidal, narrows markedly in front, convex and smooth on disk.

101 Base of labrum reddish-rust, glabrous, broadly rounded at anterior

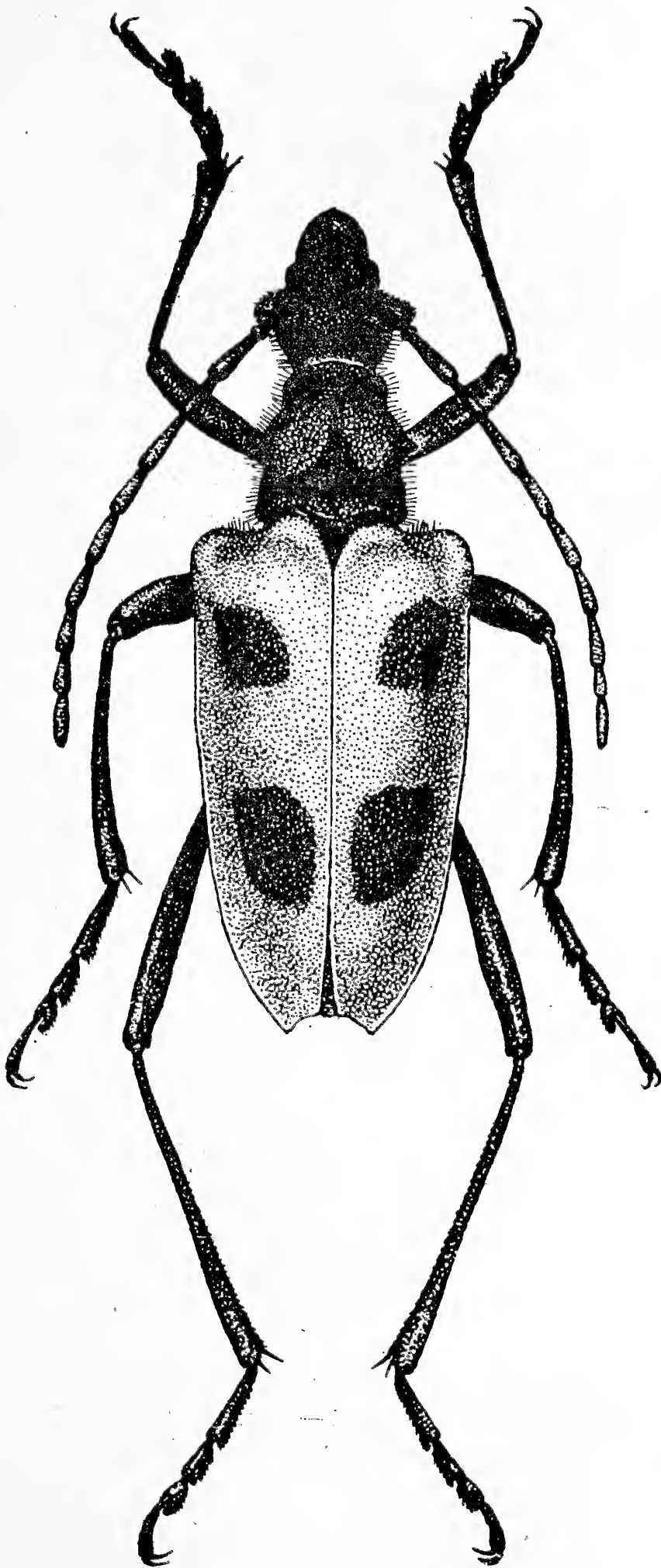


Figure 40. *Pachyta quadrimaculata* (L.).

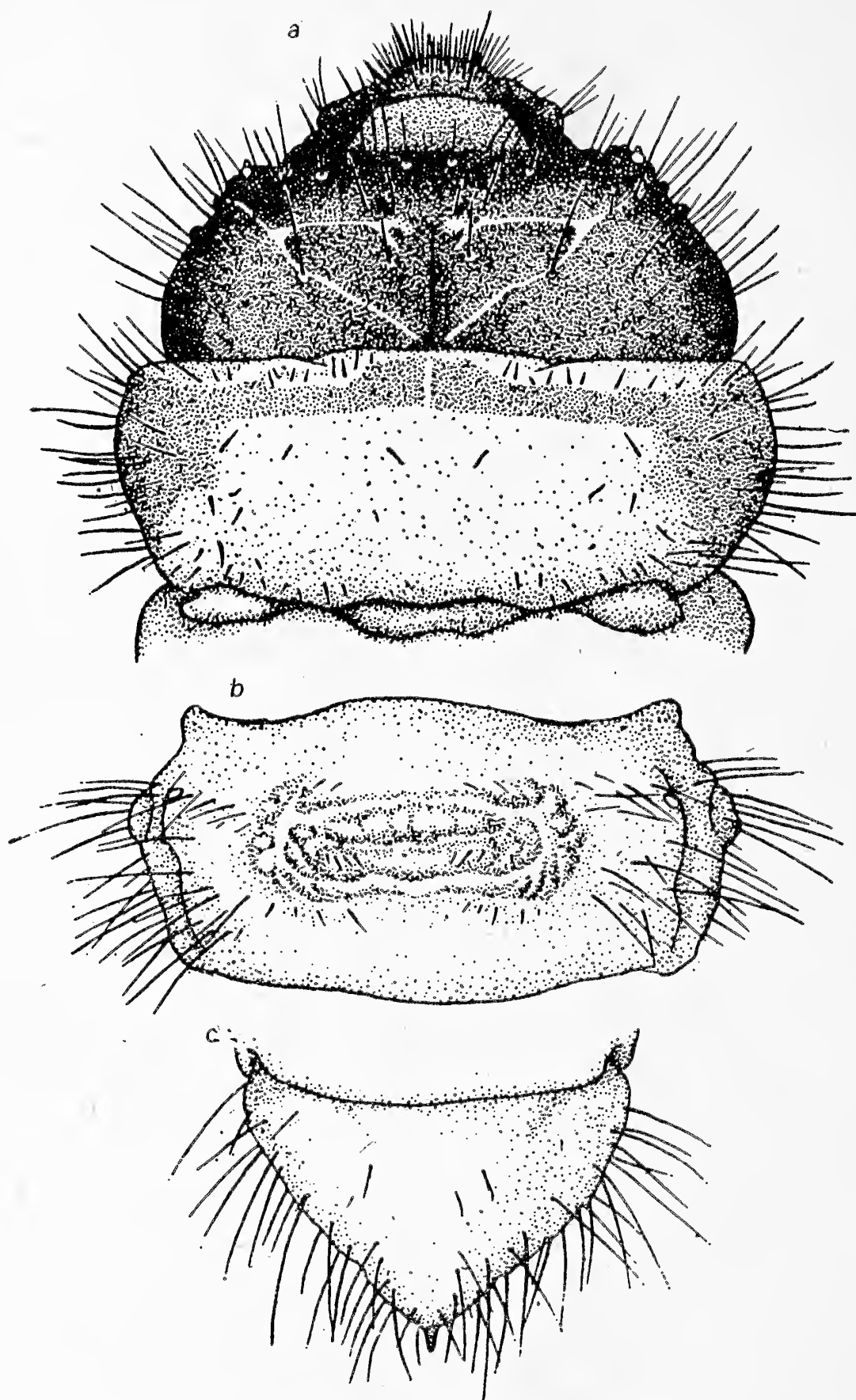


Figure 41. Larva of *Pachyta quadrimaculata* (L.).
 a—head and pronotum; b—abdominal tergite with
 locomotory ampulla; c—tip of abdomen.

margin, with long coarse setae. Mandibles elongate, obliquely truncate apically, with transverse grooves on outer side, longitudinal striation subapically. Ocelli (anterior three and posterior two) on sides of head well developed as convex hyaline bodies. Lower ocellus lacking.

Pronotum short, length 0.33 width, flat, laterally without longitudinal folds, smooth; anterior margin with several widely separated setae forming transverse row, disk with sparse hairs. Pronotal shield faint, merges with general surface. Eusternum convex, triangular, narrowly rounded anteriorly, lustrous apically, matte basally. Thoracic legs well developed, claws thin and slightly sclerotized.

Abdomen narrows slightly at tip. Abdominal tergites convex, laterally with light rust hairs. Dorsal locomotory ampullae shagreen, divided by transverse grooves into two more or less distinct carinae. Ventral locomotory ampullae divided by single transverse groove and oblique striation diverging from it, with shagreen sculpture. Abdominal tergite VIII in mature larvae transverse. Tergite IX basally glabrous, with two setae on disk anterior to middle and four in posterior half forming two transverse rows; numerous long setae laterally; and thin, sharp, highly sclerotized spine apically. Body white; head reddish-rust, blackish-brown on anterior margin of epistoma; mandibles black; sides and anterior margin of pronotum yellowish-rust or bright reddish-rust. Length of mature larva up to 33 mm, width of head 6.0 mm.

Pupa (Figure 42): Body large, convex dorsally. Head narrowly bent under, with separated setae, of which three occur on each side at base of clypeus, two in middle in front of antennae, four at base of each antennae, and three to four (tufts) on each side behind antennae and eyes. Antennae short, flexed to sides, with apices bent ventrad, reach beyond midfemora.

Pronotum narrows anteriorly, with broad flange on anterior margin, glabrous disk, and transverse coarse striation; short setae on raised anterior margin form transverse band; large thick setae set on papilliform base along posterior margin form dense transverse row; slightly concave in middle, usually produced laterally into setaceous tubercle. Mesonotum bulges, with transverse striation, glabrous (female) or with pair of widely separated setae (male). Metanotum with pair of markedly projecting setaceous tubercles. Hind femora with long sparse setae in distal third.

Abdomen narrows toward tip. Abdominal tergites bulge; posterior half with minute comparatively dense setae forming transverse band. Posterior margin of tergite IX produced into indistinct nonsclerotized spine. Sides of abdominal sternites with sparse piliform setae. Valvifers of female hemispherical, separated by small gap, apically project laterally. Length of body up to 25 mm, width of abdomen up to 7.0 mm.

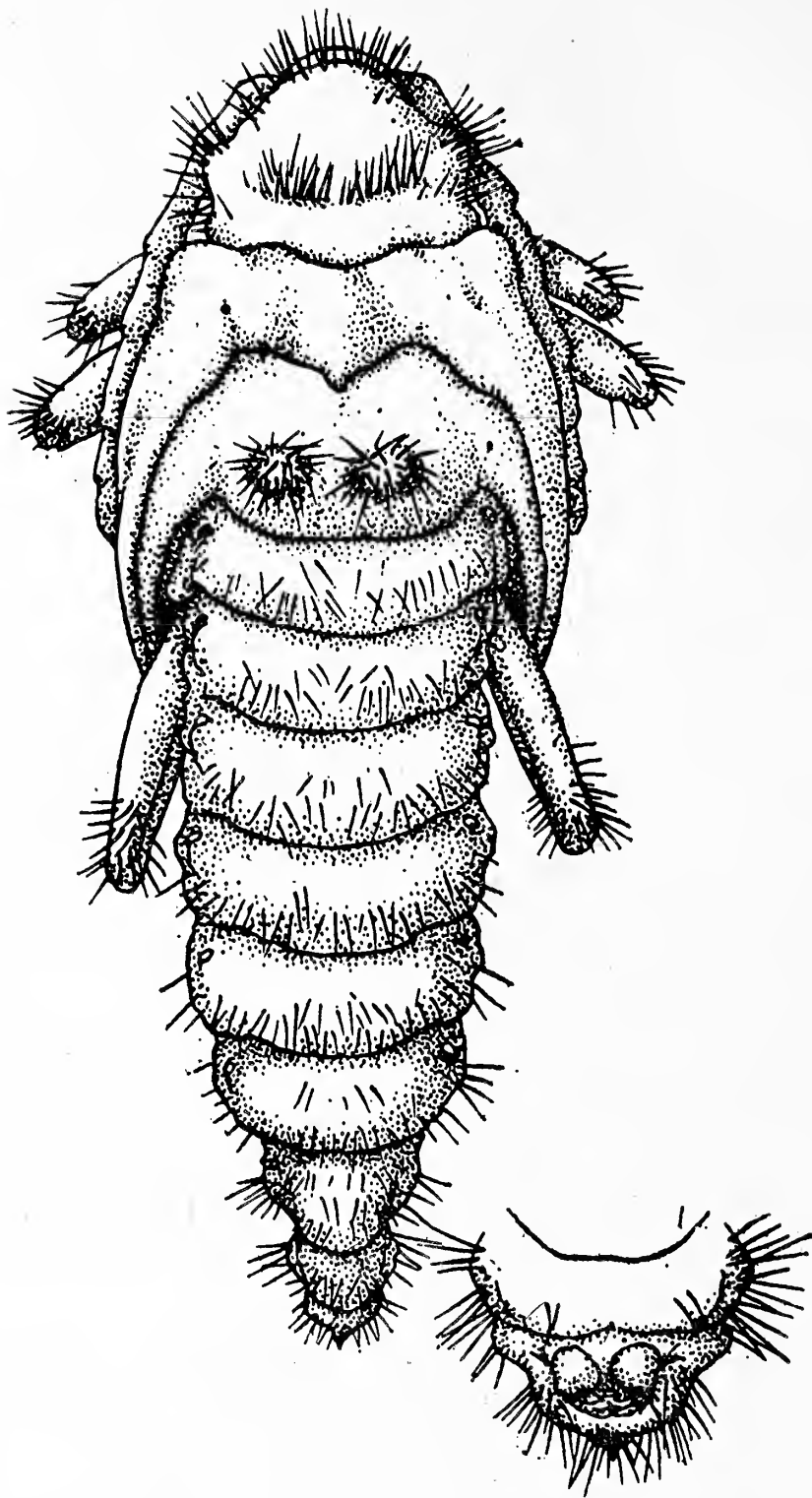


Figure 42. Pupa of *Pachyta quadrimaculata* (L.), female.

Material: Collected in Ob' region, in Altai, around Yenisey taiga, Tuva, and Trans-Baikal. Adult insects 866, larvae 106, and pupae (male and female) five.

Distribution: From Atlantic Ocean coast to Shilka and Argun' in Trans-Baikal inclusive; Mongolia and northern China. Found in large numbers in Siberia, eastern Ural region, central Ob' region, foothills of Altai, and western Sayans.

Biology: Inhabits mainly pine plantations, and ecologically associated with pine (*Pinus sylvestris*). Extends to 500 m above sea level in

mountains, rarely beyond. Flight of beetles commences early June and ceases in August. Some specimens found even in early September. During systematic collections near Lake Telets, of the 379 beetles collected 3.7% were found in June, 73.9%—July, and 22.4%—August. Beetles maximum in last 10 days of July. They usually disappear by end of August. Beetles feed on flowers, mainly of Umbelliferae. Female lays eggs on soil and in roots of decaying and dead trees. Mature thick-trunked trees colonized, basal part of shoots not being suitable. These beetles are characterized by high fecundity. For example, ovaries of one female (weight 570 mg) caught on a flower contained 411 eggs. Ovipo-
 104 sition commences in July and continues until flight of beetles ceases. Maximum eggs laid in middle 10 days of August. According to my observations in Altai, incubation period at a temperature range of 5.2 to 32.0°C (daily average $17.1^{\circ} \pm 0.5^{\circ}\text{C}$) was 11 to 28 days (average 21.6 ± 0.1 days). Hatching of larvae in nature commences end of July and ceases by mid-September. Maximum number occurs in second half of August. Thus under natural conditions, in an experiment in Altai in 1984*, larvae hatched as follows: end of July—2.1%, first 10 days of August—11.0%, second 10 days—25.6%, last 10 days of August—43.9%, and first 10 days of September—17.4%.

Young larvae bore into bark of roots, make galleries underneath it, extend them into alburnum and later, after first hibernation, penetrate deeper into wood, drill long galleries there, and plug them with frass. Larval galleries remain hollow for quite some length (not filled with frass) and larvae move freely in them. Width of gallery in wood ranges from 9.0 to 20.0 mm, at places up to 27 to 30 mm. Larvae usually colonize secondary and tertiary roots of 2.0 to 10.0 cm in thickness at a depth of 5.0 cm or more in soil and 0.5 to 3.0 m away from trunk. Larvae found on roots of dead and decaying trees of common pine. I did not find them on roots of other conifers or on pine undergrowth. Larvae in thin roots damage almost all of the wood, with only the bark remaining intact. Usually one larva, rarely two or more, live in one root. After third hibernation larvae abandon galleries, make pupal cell in upper layer of soil, polish its inner walls, and pupate. Length of cell 25 mm, width 20 mm. Cells located 5.0 to 7.0 cm from root and 50 cm or more from trunk.

Pupation commences end of May and ceases in June. Pupae maximum in second half of June. Beetles emerge from pupae mid-June and July, remain in cell for about one week, then emerge onto soil surface. Generation completed in three years (Table 3). Weight of larvae before

*Obyious misprint in Russian original which was published in 1979—General Editor.

Table 3. Development of *Pachyta quadrimaculata* (L.)

Year of development	April	May	June	July	August	September	October
1st	L	LP	LPA	PAE	AEL	EL	L
2nd, 3rd	L	L	L	L	L	L	L
4th	L	LP	LPA	PAE	AEL	EL	L

pupation 146 to 852 mg, pupae 133 to 717 mg, and adult insects 126 to 615 mg. One larva before pupation weighed 394 mg (100%), pupa developed from it 354 mg (90%), and adult emerging from pupa 256 mg (65%). The following were found together with this species on the same trees: *Asemum striatum* (L.), *Arhopalus rusticus* (L.), and *Spondylis buprestoides* (L.). However, *P. quadrimaculata* (L.) colonizes roots away from trunk, while the other three species live at the root base and around base of trunk.

2. *Pachyta bicuneata* Motsch.

Motschulsky, 1860, *Schrenks Reise, Coleopt.*, p. 147; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 185-186; Gressit, 1951, *Longicorn Beetles of China*, vol. 2, p. 59; Kojima and Okabe, 1960, *Food Plants of Japan. Cerambycidae*, p. 11.

Adult (Figure 43): Characterized by elongate pronotum and longitudinally elongate, sharply projecting black spots covering most of posterior half of elytra. Body broadens at shoulders, markedly narrows toward posterior end. Head behind eyes comparatively narrows sharply, with dense punctation. Antennae in female extend beyond 0.50, in male beyond 0.75 length of elytra.

Pronotum distinctly elongate, width at base markedly less than length; laterally with conical, usually pointed tubercle, with median longitudinal groove, broad sloping flange on anterior margin, and transverse deep groove at base; with dense large punctation and sparse erect hairs. Scutellum triangular, elongate, pointed backward.

Elytra elongate, narrow markedly from humeri to apex, slightly notched or truncate at apex, and with large punctation. Legs long and slender. Body, antennae, and legs black. Elytra straw-yellow, in posterior half with longitudinally elongate black spot broadening forward (f. *typica*); sometimes with two parallel, more or less developed black spots in anterior half (ab. *bisbinotata* Pic) or with one broad spot (ab. *bisbimaculata* Pic), rarely entirely straw-yellow, devoid of black spots (ab. *incolumis* Heyd.). Length of male and female 12 to 20 mm.

Egg: White, thin, narrowly rounded at poles, with minute cellular

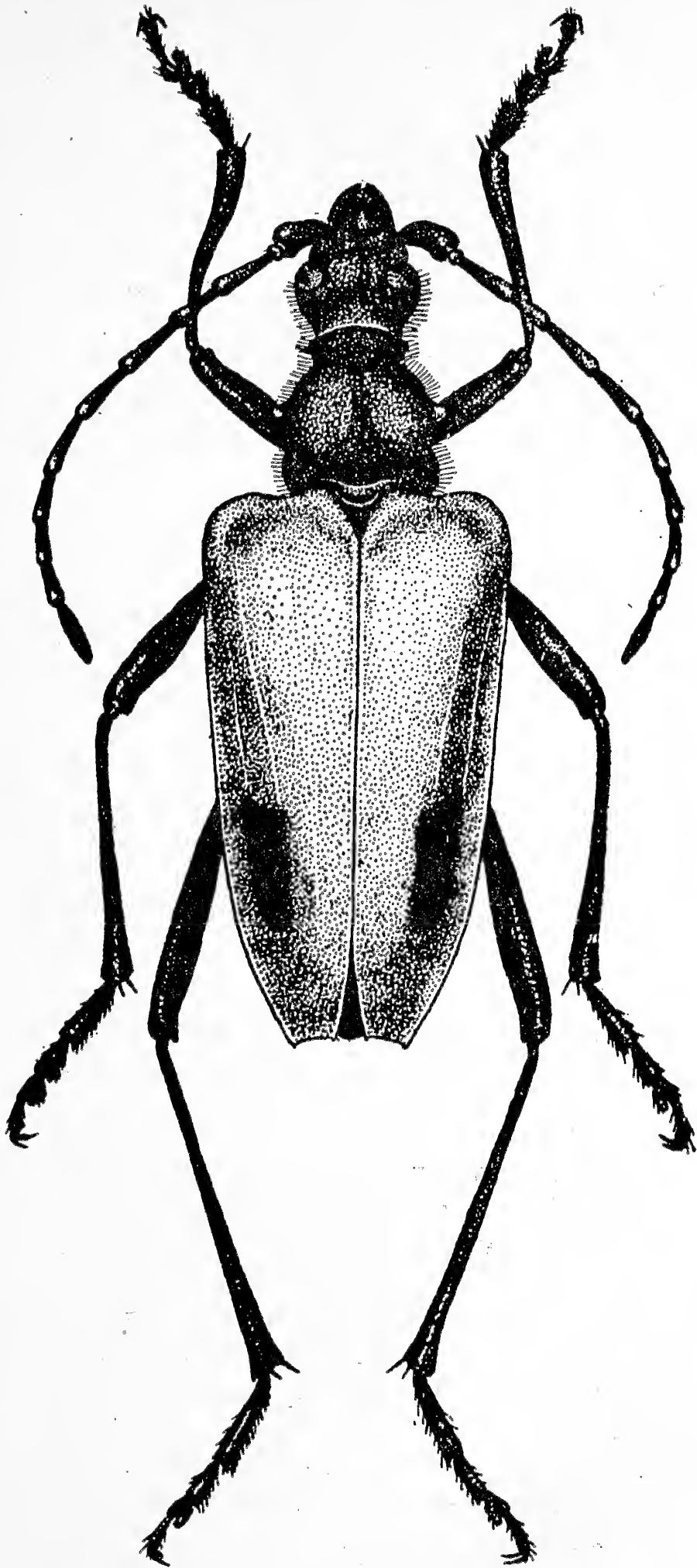


Figure 43. *Pachyta bicuneata* Motsch.

sculpture; cells elongate with narrow spaces between. Length 1.9 mm, width 0.5 mm.

Larva (Figure 44): Readily distinguished from larvae of other species in poorly developed ocelli on head. Body elongate. Head slightly retracted into pronotum, narrows steeply on sides toward base, and gently rounded forward. Epistoma pointed backward; frontal sutures narrow but distinct, white; transverse white band medially interrupted; longitudinal suture divides epistoma only in posterior half. Hypostoma flat, entire; medially with longitudinal white line with one or two setae along each side of it forming transverse row. Ocelli on head usually three; posterior pair often lacking, only sometimes barely visible; lower unpaired ocellus lacking.

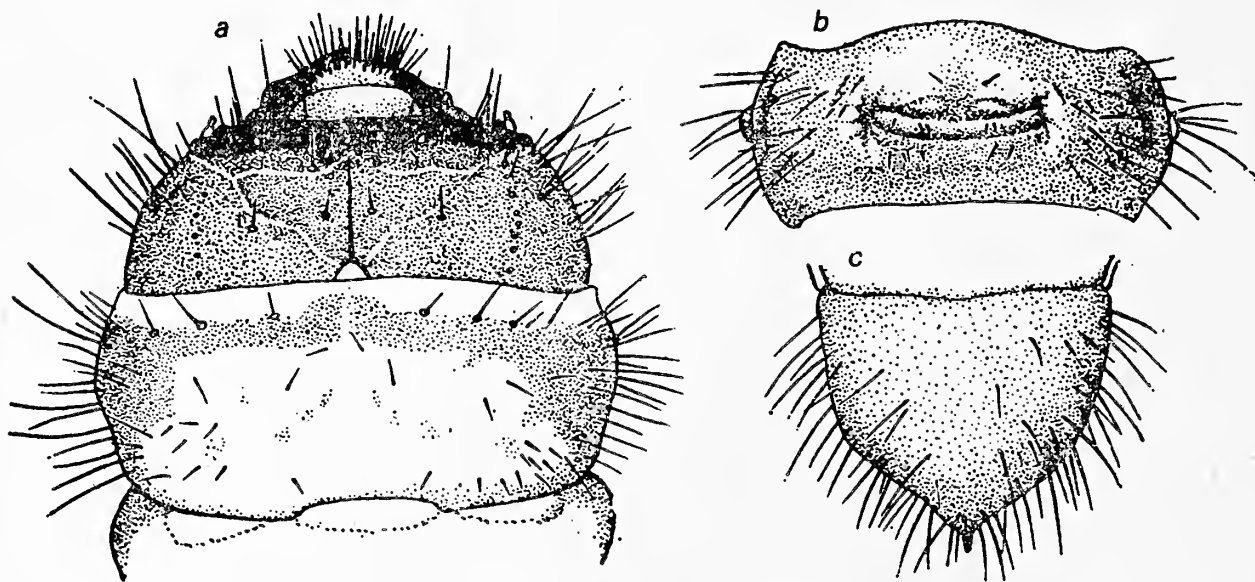


Figure 44. Larva of *Pachyta bicuneata* Motsch.
a—head and pronotum; b—abdominal tergite with locomotory ampulla; c—tip of abdomen.

Pronotum 2.5 times wider than long; transverse yellow band on anterior margin with widely separated short setaceous hairs forming transverse row; long sparse hairs on sides and posterior angles, and glabrous or with stray hairs on disk. Pronotal shield with faint striation, almost not distinguishable from general background. Eusternum smooth, entire surface more or less lustrous, shagreen sculpture lacking at base. Thoracic legs slender; claws long and acicular, almost straight, well sclerotized.

Abdomen elongate, with long hairs laterally. Dorsal locomotory ampullae convex, shagreen, divided by transverse grooves into two transverse carinae; two contiguous sessile setae on each side of posterior carina. Ventral locomotory ampullae bulge slightly, shagreen, divided in posterior half by transverse groove, without noticeable striation,

with smooth nongranulate surface. Abdominal tergite VIII longitudinal, never transverse. Tergite IX notably produced posteriorly, terminates in small pointed spine, glabrous in anterior half, with long hairs laterally and in posterior half. Body white, head reddish-rust, pronotum yellowish-rust laterally and along anterior margin. Length of body up to 28 mm, width of head about 5.0 mm.

Pupa (Figure 45): Head markedly bent under and elongate, transversely depressed behind and in front of antennae. Antennae flexed to sides, arcuate, and turn around midfemora.

Pronotum convex, produced into setaceous tubercle laterally, markedly narrows anteriorly, with posterior half more enlarged in female, less so in male, and sharp flange on anterior margin; thin setae on anterior raised margin form transverse band, coarse long setae basally

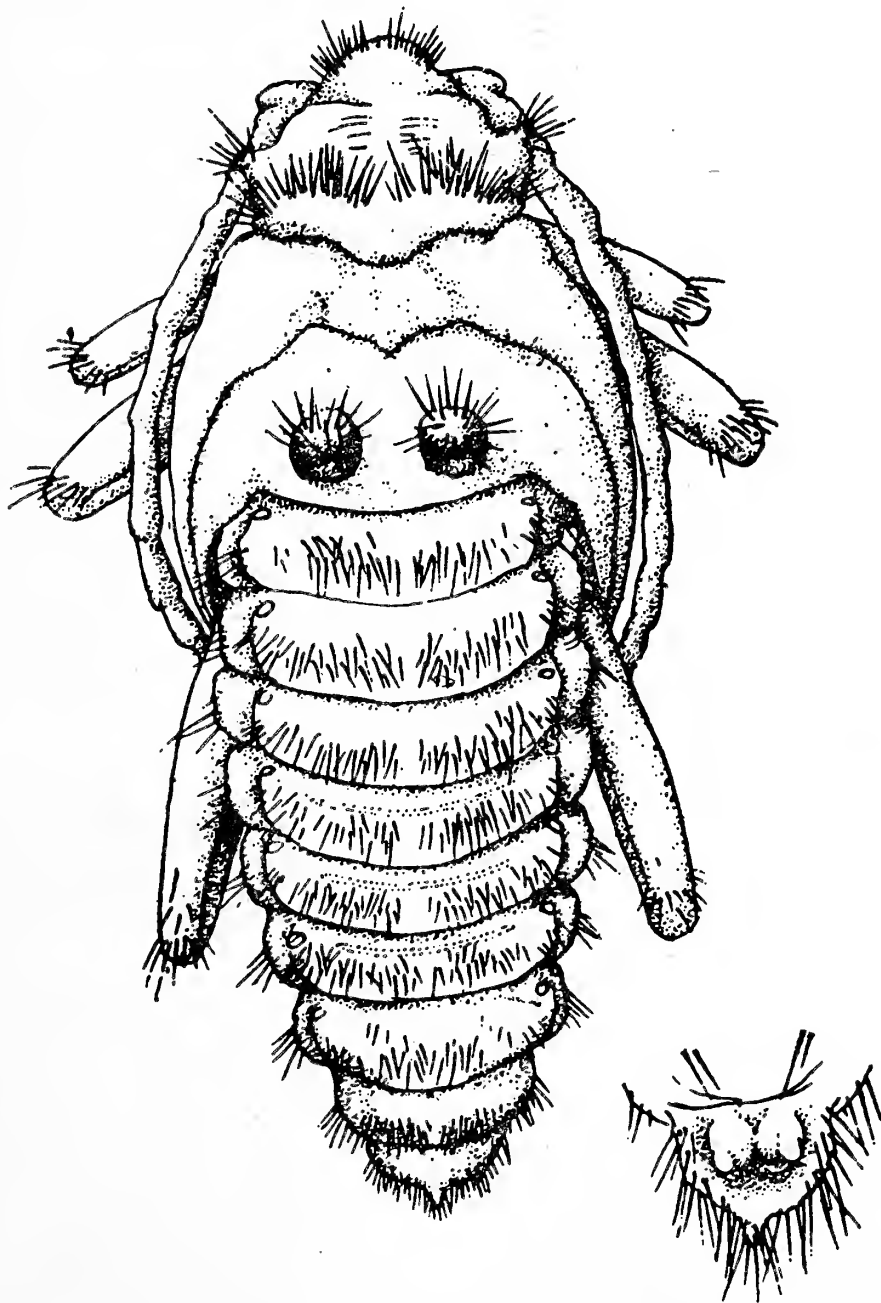


Figure 45. Pupa of *Pachyta bicuneata* Motsch., female.

- on protuberant base form dense, sometimes slightly jumbled transverse row, directed backward in middle, and fine transverse striation on disk.
- 107 Mesonotum glabrous, with transverse striation, more convex in male. Metanotum produced into a pair of long tubercles densely covered with setae on apex. Hind femora with thin setae only at apex, glabrous otherwise.

Abdomen more elongate in male, broadens in female, narrows toward apex. Abdominal tergites moderately convex, with sparse pili-form setae in posterior half forming transverse band. More or less developed nonsclerotized spinule located at tip of abdomen. Abdominal sternites laterally with sparse thin hairs. Valvifers of female hemispherical, somewhat widely separated, with papilliform tubercle at apex. Length of body 15 to 19 mm, width of abdomen up to 5.0 mm.

Material: Collected in Ussuri-Primor'e region and on Sakhalin Island. Adult insects over 200, larvae 37, pupae nine, larval exuviae with beetles from cells seven.

Distribution: Eastern regions adjoining Amur River. Ussuri-Primor'e and Sakhalin, northern Korea, northeast China.

Biology: Inhabits coniferous and mixed vegetation, prefers forests containing Korean pine (*Pinus koraiensis*). Beetles sighted in last 10 days of June and disappear in second half of August. Large numbers observed in last 10 days of July. During systematic collection in 1971, of every 100 beetles six were found in June, 62—July, and 32—August. Beetles feed on flowers, often infest mountain ash groves (*Sorbaria sorbifolia*), feed on petals, and gather pollen. Ovaries of one female caught on flowers contained 198 eggs. Female lays eggs on roots of Korean pine. Oviposition commences toward end of June and terminates toward end of August. Development period of eggs from time of oviposition to hatching of larvae at $20.3^{\circ} \pm 0.8^{\circ}\text{C}$ is nine to 14 days, average 12.2 ± 0.1 days.

- Larvae initially live under bark and make galleries that do not touch alburnum. They later bore into wood and leave longitudinal galleries behind them in upper layers, which are plugged with fibrous frass. After third hibernation mature larvae emerge from roots into upper layer of soil at a depth of 2.0 cm, make an oval cell there, and pupate. Length of cell 23 to 25 mm, width 14 to 21 mm. Pupation of larvae
- 108 commences mid-May and ceases in first half of June. In 1973 in the Komarovka River region close to Ussuri, 75 of every 100 larvae pupated by June 1st and 25 during the remainder of this month. Pupae develop for not less than three weeks. Beetles emerge from pupae commencing mid-June and terminating early July. Beetles maximum in first half of June.

Weight of larvae before pupation 152 to 416 mg, pupae 139 to

379 mg, and young beetles 89 to 289 mg. One larva before pupation weighed 229 mg, pupa 221 mg, and adult emerging from it 145 mg, i.e., during metamorphosis the total weight of insects dropped by 26.7%.

Beetles of this species colonize roots 6.0 cm in diameter and above. Density of colonization sometimes significant. Once 12 pupae were found around a root 1.42 m long and 5.0 to 6.0 cm thick. Larvae found only on Korean pine and no other species. According to Japanese authors (Kojima and Okabe, 1960), this species is found on Korean spruce (*Picea koraiensis*) and Korean larch (*Larix olgensis*).

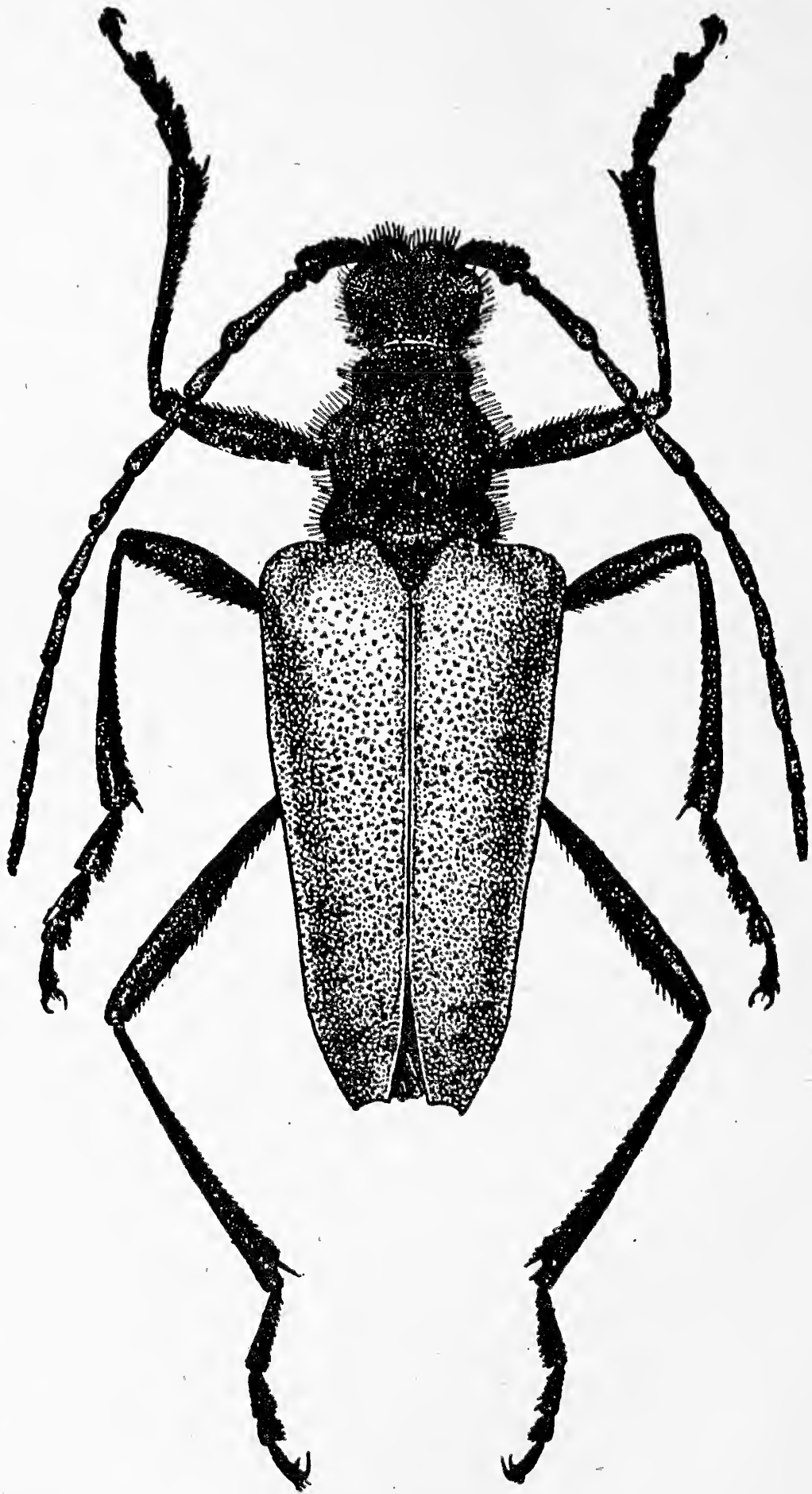
3. *Pachyta lamed* (L.)

Linnaeus, 1758, *Syst. Nat.*, 10th ed., p. 291 (*Leptura*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 181-183; Gressitt, 1951, *Longicorn Beetles of China*, vol. 2, pp. 59-60; Kojima and Okabe, 1960, *Food Plants of Japan. Cerambycidae*, p. 11; Demelt, 1966, *Die Tierwelt Deutsch.*, vol. 52, p. 36 (Cerambycidae); Kojima and Hayashi, 1969, *Insect Life in Japan*, vol. 1 (Longicorn Beetles), p. 10; Linsley and Chemsak, 1972, *Cerambycidae of North America*, vol. 6, pp. 66-67.

Adult (Figure 46): Characterized by fine punctation on pronotum, more distinct sexual dimorphism, and acutely produced angles on elytral apex. Head comparatively short, with minute dense punctation. Antennae in female short, extend beyond middle of elytra; longer in male, with apices almost reaching posterior end of body.

Egg: White, elongate, broadly rounded at one pole, narrowly at the other, with fine cellular sculpture. Cells longitudinally elongate, spaces between them narrow, resemble septa. Length 2.0 mm, width 0.6 mm.

Larva (Figure 47): Differs from larvae of other species of this genus in well-developed unpaired lower ocellus, denser hair cover on abdominal tergites VIII and IX, large setae on posterior carina of dorsal locomotory ampullae, pleural setae around suture, and some other features. Head somewhat retracted into prothorax, rounded laterally, narrows more anteriorly. Epistoma broadly rounded apically, with very straight sides. Frontal sutures subapically almost not concave, almost straight; transverse white band between sutures not turned forward much in middle, with longitudinal suture at this point extending forward beyond it. Pleural setae in posterior half shifted toward frontal suture, space between them not more than diameter of seta. Additionally, much shorter pleural setae located near suture in front. Hypostoma narrows anteriorly, medially with sharp longitudinal white band that perceptibly widens backward, with four setaceous pores forming transverse row, sometimes with some additional pores. Clypeus convex and smooth, narrows in front. Labrum convex with dense setae in anterior half, highly sclerotized at base. Outer side of mandibles without



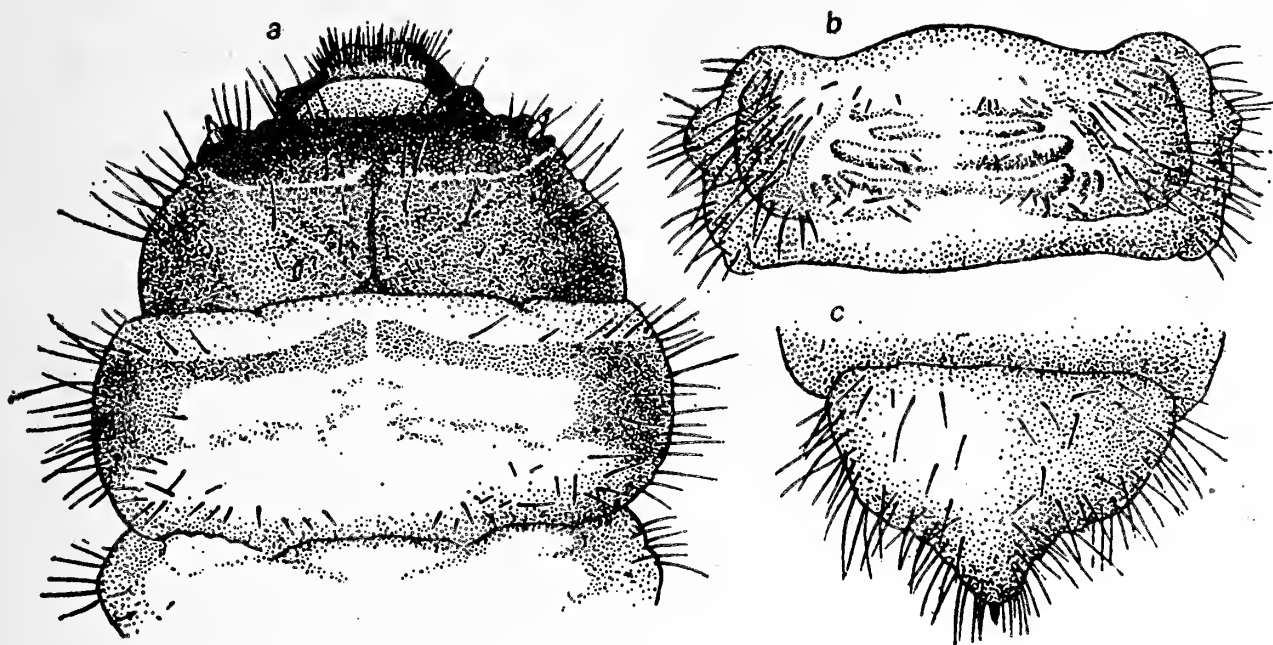


Figure 47. Larva of *Pachyta lamed* (L.).

a—head and pronotum; b—abdominal tergite with locomotory ampulla; c—tip of abdomen.

subapical longitudinal striation. Ocelli on head six ($3 + 2 + 1$), well developed, hyaline. Posterior pair of ocelli proximate, lower unpaired ocellus distinct and bright, sometimes in form of minute white spot.

Pronotum 3.0 times wider than long, slightly convex, almost flat, glabrous on disk, with tender long hairs laterally forming three more or less distinct transverse bands—medially and along anterior and posterior margins. Pronotal shield slightly convex, anteriorly sometimes with border of rusty setae. Eusternum convex and triangular, lustrous, with six setae along sides of apex. Legs well developed, with numerous setae on lower (inner) side. Claws thin, acicular, and sclerotized.

Abdominal tergites laterally with numerous setae, sparse setae posterior to locomotory ampullae and short setae anterior to them forming transverse row. Dorsal locomotory ampullae with two transverse shagreen sclerotized carinae, of which posterior one with setaceous hairs directed medially. Tergite IX produced posteriorly into sharp brownish spine; posterior half with hairs that form more or less distinct transverse rows. Tergite VIII in posterior half and laterally covered with sparse hairs. Body white. Head red or reddish-rust. Pronotum along sides and anterior margin rusty, in middle with longitudinal white band, before scutum with rusty speckles. Length of body up to 28 mm, width of head up to 5.5 mm.

Pupa (Figure 48): Differs from those of other species of this genus in absence of coarse transverse wrinkles on pronotum. Head elongate anteriorly, markedly bent under, transversely convex between antennae,

and here with sparse coarse setae, flat between upper lobes of eyes, with large setae along sides in region of occipital protuberances. Antennae arcuate, bend round femora, with apices pressed ventrad.

- 111 Pronotum markedly narrows anteriorly, in anterior third with flange, on anterior margin with thin setae on protuberant coriaceous digitate base forming dense transverse row interrupted medially; laterally produced into tubercle with numerous long setae; disk slightly convex, almost flat, smooth, without coarse transverse striation, glabrous, only sometimes with stray setae, thick acicular setae on protuberant coriaceous base, slightly retracted. Mesonotum convex, with thick long setae on sides at elytral base (female) or without them (male). Metanotum transverse, with pair of large hemispherical, densely setaceous tubercles. Femora markedly flexed dorsally, with long setae apically.

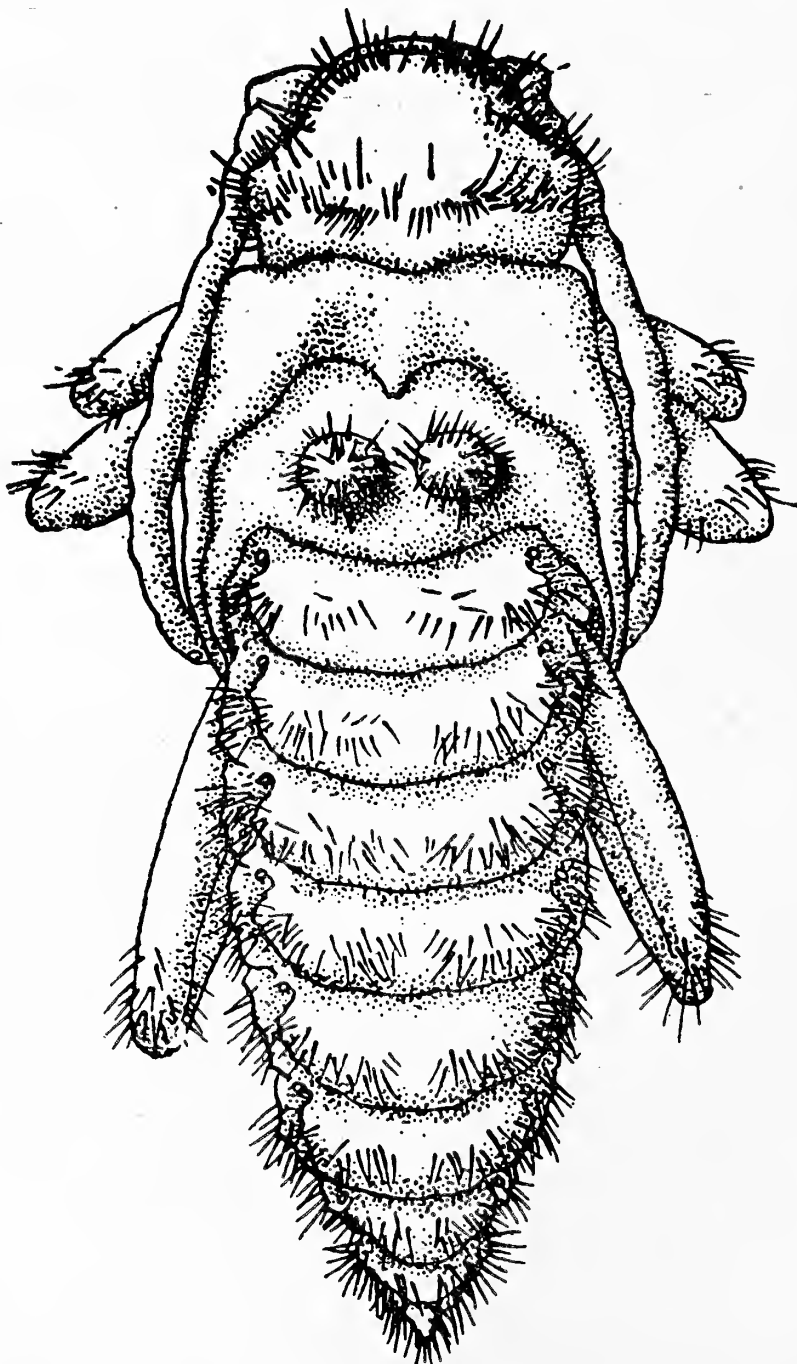


Figure 48. Pupa of *Pachyta lamed* (L.).

Abdomen narrows gradually posteriorly, ventrally bent under at tip. Abdominal tergites in anterior half smooth, glabrous, more convex behind middle, with long setae forming transverse band interrupted medially by narrow clearance. Abdominal tergite IX produced posteriorly into slightly sclerotized spinule. Abdominal sternites laterally with long setae (male) or short thin setae forming tufts (female). Valvifers of female hemispherical, with laterally produced tubercle at apex. Length of body 13 to 20 mm, width of abdomen 4.0 to 5.0 mm.

Material: Collected in Altai, Ob' region, Tuva, along middle course of Yenisey, in Baikal region, Trans-Baikal, Ussuri-Primor'e region, and Sakhalin. Adult insects 57, including seven raised in the laboratory, larvae 60, and pupae (male and female) three.

Distribution: Europe, northern Asia, North America. In Siberia, from the Urals to Pacific Ocean coast in coniferous forests. Found sporadically, mainly in foothills and mountain regions.

Biology: Inhabits coniferous forests with viable spruce. Flight of beetles commences end of June and terminates mid-August. More often beetles seen in second half of July on flowers, on which they feed. Later they mate and lay eggs on thin roots of decaying thick-trunked trees. Ovaries of one female (weight 220 mg) dissected on fifth day after removal from pupal cell, contained 104 mature eggs.

After hatching larvae bore into bark of thin roots, usually up to 1.0 cm in diameter, live initially under bark, then penetrate into wood, make longitudinal galleries directed from apex of root toward base, and plug them with fine frass. In due course larvae migrate from thin secondary roots to thicker primary ones. Galleries made in upper wood layer of thick roots, up to 10 cm in diameter. Almost entire wood of thin roots damaged, leaving behind only bark plugged with frass. Width of galleries made by mature larvae 2.0 to 3.0 cm. Sometimes galleries widen into platform. Larvae of last instar abandon roots before third hibernation, migrate into soil, and make pupal cells there at a depth of 3.0 to 5.0 cm. Length of cell 20 mm, width 16 mm. Sometimes cell made in undergrowth on soil. Under laboratory conditions, in a refrigerated chamber, larvae emerged from roots brought from Tuva at the end of September, at a temperature of 5.4 to 1.9°C (average 7.2°C).

Pupation proceeds after hibernation in May and ceases in June. Soil temperature during pupal development in nature (Tuva, Khendergei River) 10.5 to 12.0°C. Young beetles appear end of June and in July. Weight of larvae on emerging from roots 105.5 to 465.0 mg, and weight of beetles taken from pupal cell 78 to 240 mg (male 78 to 140 mg, female 135 to 240 mg). During metamorphosis the weight of insects drops to a level characteristic of the entire family Cerambycidae.

For example, four insects in prepupal stage weighed 942 mg (100%),

in pupal stage 812.1 mg (86.2%); another three insects in pupal stage weighed 712 mg (100%) and in adult stage on emerging from pupae 540.5 mg (76.9%). During the prepupal period weight dropped by 13.8% and at the end of pupal period by 23.1%. Generation completed in three years. I found this species on the roots of old thick stumps of decaying trees of Siberian spruce (*Picea obovata*). According to a report by Kojima and Okabe (1960), it develops on Korean spruce (*Picea koraiensis*) and Korean larch (*Larix olgensis*). *Asemum striatum* (L.) and *Rhagium inquisitor* (L.) quite often colonize the thick exposed roots of the same trees as this species.

6. Genus *Brachyta* Fairm.

Fairmaire, 1868, *Genera des Coleopteres d'Europe*, vol. 4, p. 185.

This genus is close to the genus *Pachyta* Zett.

Adult: Differs in the following features: Head notably elongate, eyes convex, slightly emarginate. Antennal apices barely reach beyond middle of elytra in male, do not reach this level in female. Pronotum narrows markedly more anteriorly than posteriorly, with obtuse conical tubercle laterally, broad flange anteriorly, with dense punctation. Elytra significantly wider than pronotum, bulge, with projecting humeri, rounded or slightly obtuse apically. Legs moderately long, hind femora thicken gradually from base to apex, hind tarsi shorter than tibiae. First segment of hind tarsi broad, not longer or slightly longer than next two segments together; 3rd segment deeply notched.

Larva: Body thick, head and pronotum insignificantly flat, thoracic legs developed. Abdominal tergite IX produced into tubercle posteriorly, with sclerotized spine at tip.

Pupa: Body comparatively thick and curved. Antennae short, with apices curving round only top of midfemora. Pronotum in anterior third with broad large flange, anterior raised margin as well as posterior margin bordered by dense setaceous band. Metanotum and first four abdominal tergites with paired tubercular setaceous prominences forming two common longitudinal rows. Posterior margin of tergite IX with small nonsclerotized spinule.

LeConte (1850) described the genus *Evodinus* from material of North American fauna, including the type species *Leptura monticola* Randl. Subsequently, *L. interrogationis* L., *L. borealis* Gyllh., and other species of Eurasian fauna were included in this genus. However, the morphology and ecology of these species in the preimaginal stages revealed that they constitute two independent, historically unified genera, one of which (including the species *Leptura interrogationis* L., *L. bifasciata* Oliv., *Pachyta variabilis* Gebl.) originated in close association with

herbaceous vegetation, and the other (including *Leptura monticola* Randl., *L. borealis* Gyllh.) with coniferous species.

The genus *Brachyta* Fairm. (1868), which included *Leptura interrogationis* L., was described earlier but subsequently was erroneously treated as a synonym of the genus *Evodinus* LeConte. Today, based on new investigations, the genus *Brachyta* Fairm. may be restored and the species of the first group included in it.

In USSR fauna six species of the genus *Brachyta* are known, of which two (*B. caucasica* Rost. and *B. caucasicola* Plav.) are distributed in the Caucasus, one [*B. interrogationis* (L.)] is widely distributed in northern Europe and in Asia, and three species [*B. bifasciata* (Oliv.), *B. variabilis* (Geb.), and *B. eurinensis* (Tsher.)] in northern Asia. Species of this genus are apparently not known in North America. Beetles are mainly sighted in the first half of summer when they feed on flowers. Larvae live in soil, feed on roots of herbaceous vegetation, and pupate there.

Type species: Leptura interrogationis Linnaeus, 1758.

KEY TO SPECIES

Adult Insects

- 1 (6). Elytra smooth, without perceptible longitudinal ridges.
- 2 (5). Elytral suture light-colored, not black even in melanic forms.
- 3 (4). Antennae black or blackish-brown, rarely with rusty or much lighter tone. Tibiae black, sometimes rusty at base. Found in Eurasia. 1. ***B. interrogationis*** (L.).
- 4 (3). Antennae distinctly bicolored: straw-yellow from 2nd to 5th segments, dark brown, black in remainder. Tibiae light yellow, black only at tip. Found in eastern part of northern Asia. 2. ***B. bifasciata*** (Oliv.)
- 5 (2). Elytral suture black; only in specimens with monochromatic red elytra same in color. Found in northern Asia. 3. ***B. variabilis*** (Geb.).
- 6 (1). Elytral disk with perceptible longitudinal ridges. Found in southern part of northern Asia. 4. ***B. eurinensis*** (Tsher.).

Larvae

- 1 (4). Spine on posterior margin of abdominal tergite IX broad and flat, not longer or only slightly longer than its own width at base.
- 2 (3). Abdominal tergite IX entirely covered with dense (numerous) long setaceous hairs. 1. ***B. interrogationis*** (L.).

- 3 (2). Abdominal tergite IX with stray setaceous hairs, of which four on disk form transverse row, and six on posterior margin project triangularly from base of spine. 2. **B. bifasciata** (Oliv.).
- 4 (1). Spine on posterior margin of abdominal tergite IX long, not flat, basally round, thin and elongate, 2.0 to 2.5 times longer than its width at base.
- 5 (6). Body with dense rusty hairs. Dorsal locomotory ampullae without perceptible granules. 3. **B. variabilis** (Geb.).
- 114 6 (5). Body with sparse light-colored hairs. Dorsal locomotory ampullae with distinct granules. 4. **B. eurinensis** (Tsher.).

Pupae

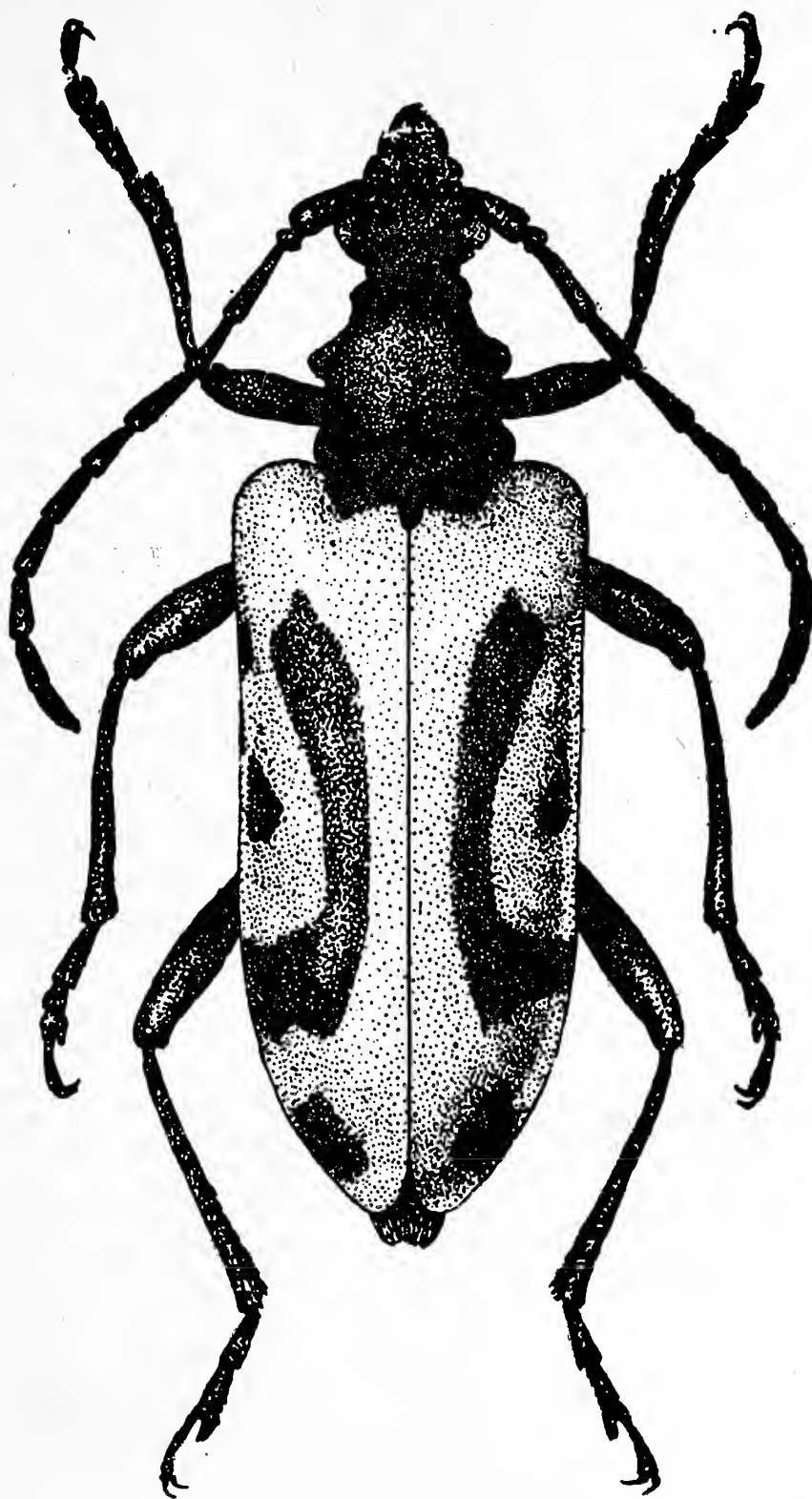
- 1 (4). Abdominal tergites VIII to IX with sparse setae, which form tufts only along sides of midline.
- 2 (3). Pronotum in anterior third of flange glabrous, without setae; on disk with stray scattered setae. 2. **B. bifasciata** (Oliv.).
- 3 (2). Pronotum in anterior third of flange with stray setae; on disk (especially paramedially) with numerous setae forming continuous diffuse cover. 1. **B. interrogationis** (L.).
- 4 (1). Abdominal tergites VIII to IX with dense setae, which form continuous setaceous cover. 3. **B. variabilis** (Geb.).

1. **Brachyta interrogationis** (L.)

Linnaeus, 1758, *Syst. Nat.*, 10th ed., p. 398 (*Leptura*); Fairmaire, 1868, *Genera des Coleopteres d'Europe*, vol. 4, p. 185; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 198-203 (*Evodinus*); Cherepanov and Cherepanova, 1971, *Nov. i maloizv. vidy fauny Sibiri*, vol. 4, pp. 17-27 (*Evodinus*).

Adult (Figure 49): Characterized by comparatively small body, variegated color, and other features. Body moderately elongate. Head directed forward and slightly downward, bulges slightly transversely between antennae, with dense punctation, narrows behind eyes, sometimes with smooth median longitudinal stripe on vertex. Eyes highly convex, finely faceted. Antennal apices barely reach middle of elytra; 1st segment thick, with dense punctation.

Pronotum somewhat longer than width at base, mediolaterally produced in obtuse tubercle, with gently sloping flange anteriorly, perceptible transverse groove at base, and slightly roundly produced posterior angles; with dense deep punctation and light-colored hairs directed backward. Scutellum triangular, with minute punctation and adherent light-colored hairs.

Figure 49. *Brachyta interrogationis* (L.).

Elytra convex, narrow toward apex almost from base, with minute punctation and short semiadherent hairs. Body black. Antennae dark brown, sometimes from 2nd to 5th segments much lighter, rusty. Legs black; tibiae sometimes rusty or yellow. Elytra rusty-straw-yellow, at base of scutum with transverse spot, on disk with longitudinal black band bent laterally, bracketlike, with two black spots on sides (in anterior half), and single apical spot on hind clivus. Pattern highly variable; over 150 aberrations from melanic (uniformly black) to light-colored

forms described, with small spots preserved on sides or on elytral disk. Length of body 9.0 to 18.5 mm, more often 12 to 14 mm.

Egg: Elongate, gently rounded at poles, with fine dense cellular sculpture, and greenish tinge. Length 1.8 mm, width 0.6 mm.

115 *Larva* (Figure 50): Similar to larva of *Brachyta bifasciata* (Oliv.). Differs in continuous transverse hairy field on anterior margin of pronotum and other features. Body thick. Half of head retracted into prothorax. Epistoma smooth, sometimes faintly striate. Frontal sutures straight and white, longitudinal suture in posterior half distinct, brownish. Transverse white band in front of middle of epistoma distinct, sometimes faint. Parietals in anterior half with long setaceous hairs. Hypostoma short, entire, narrows somewhat in front. Clypeus broad and trapezoidal, gently emarginate at anterior margin. Labrum broad, anterior margin obtuse or slopes gently, sometimes rounded at angles; with dense setae. Mandibles somewhat elongate, obliquely truncate apically, slightly hollow on inner side; sometimes with transverse groove on outer side.

Pronotum transverse, 2.5 times wider than long; hairs on sides and anterior margin form transverse field not interrupted medially; hairs at base form transverse row. Pronotal shield glabrous, coriaceous, without lateral longitudinal fold. Thoracic legs well developed, with minute sharp claws.

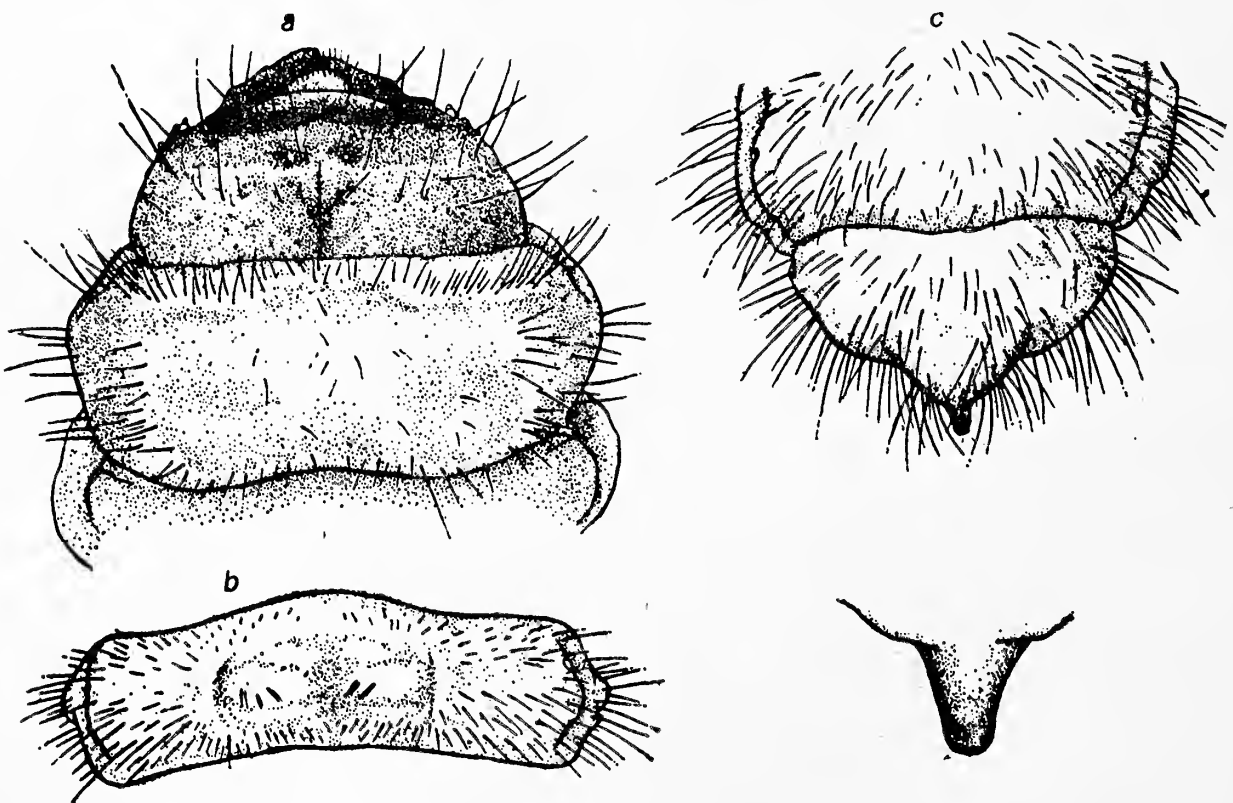


Figure 50. Larva of *Brachyta interrogationis* (L.).
a—head and pronotum; b—abdominal tergite with locomotory ampulla; c—tip of abdomen.

Abdomen narrows anteriorly, laterally with long; comparatively dense hairs. Dorsal locomotory ampullae bulge moderately, medially divided by indistinct longitudinal groove, coriaceous; consist of two transverse carinae, of which anterior one small and posterior very long; with three setae on each side. Abdominal tergite IX with long dense hairs on sides and disk, triangularly produced tubercle at apex, and sclerotized spine on posterior margin. This spine somewhat less in width at base than length, depressed, trough-shaped on upper side, and usually rounded at tip. Larvae with biapical spine very rarely seen. Anal tubercles on outer side with long dense hairs. Body white. Pronotum yellow laterally, with narrow transverse yellow band on anterior margin. Head reddish-rust. Mandibles black. Length of body up to 20 mm, width of head 3.0 to 3.5 mm.

Pupa (Figure 51): Body markedly recurved, almost arcuate (lateral view). Head elongate, bent under, negligibly transversely convex between antennae, with three minute setae along sides of this protuberance. Antennae flexed to sides, bent ventrad behind midfemora.

116 Pronotum narrows markedly anteriorly, anterior third with broad gently sloping flange; long piliform setae cover almost entire surface, but very dense in posterior half and along anterior raised margin; setae on posterior raised margin of pronotum form dense transverse band. Mesonotum slightly convex, transversely rugose, with group of short paramedial setae. Metanotum transversely striate, behind middle with pair of paramedial prominences, densely covered with setae.

Abdomen bent under. Abdominal tergites I to IV with median longitudinal groove, and paramedial tubercular prominences densely covered with piliform setae. Tergites V to VII flat, without prominences, and with sparse setae; tergite VIII with long dense lateral setae; tergite IX with sparse setae, produced apically, and with barely noticeable nonsclerotized spinule. Length of body 10 to 17 mm, width of abdomen 7.0 to 8.0 mm.

Material: Collected in territory from the Urals to Pacific Ocean coast. Adult insects 9,576, larvae 496, pupae 26.

Distribution: Eurasia, from Atlantic to Pacific Ocean coasts. In Siberia, mainly central and southern forest zone, extending in mountains up to 2,000 m above sea level.

Biology: Inhabits forests and forest-steppe zones. Most numerous in foothill and mountain regions. Flight of beetles commences in May and continues up to mid-July or almost up to August. Beetles maximum end of May and first half of June, i.e., during plant flowering.

In 1968 in Salair, of the 3,139 beetles collected, 18.9% were found in last five days of May, 67.3%—first half of June, 13.5%—second half of June, and only 0.3% up to July 20. In the high-altitude alpine zone

flight of beetles shifts to second half of summer. Here they are sighted in large numbers around mid-July. Beetles readily feed on flowers of Umbelliferae (*Bupleurum aureum*, *Heracleum dissectum*, *Archangelica decurrens*, *Angelica sylvestris*), Ranunculaceae (*Paeonia anomala*, *Trollius asiaticus*), spurge (*Euphorbia pilosa*), Rosaceae (*Rosa cinnamomea*), and other plants. They sometimes feed on the tissues of green leaves and petals and actively gather pollen. They mate on the same plants. These beetles are most active from 11:00 a.m. to 1:00 p.m. and 4:00 to 7:00 p.m. In hot weather, during rains, and at night, they hide under a grass cover. Their habitat is restricted to forest clearances, mountain slopes with sparse woods, well-developed mixed grasses, and rarely forests

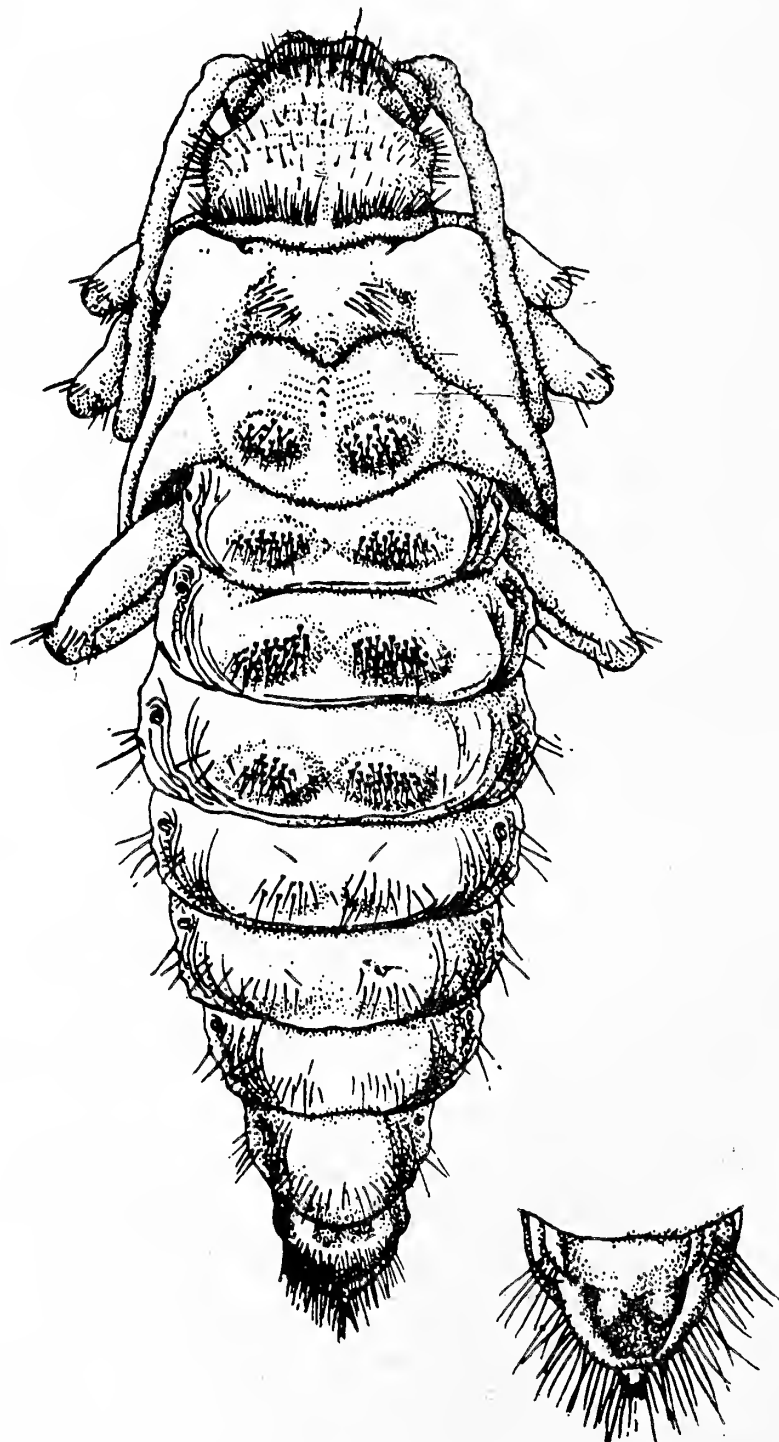


Figure 51. Pupa of *Brachyta interrogationis* (L.).

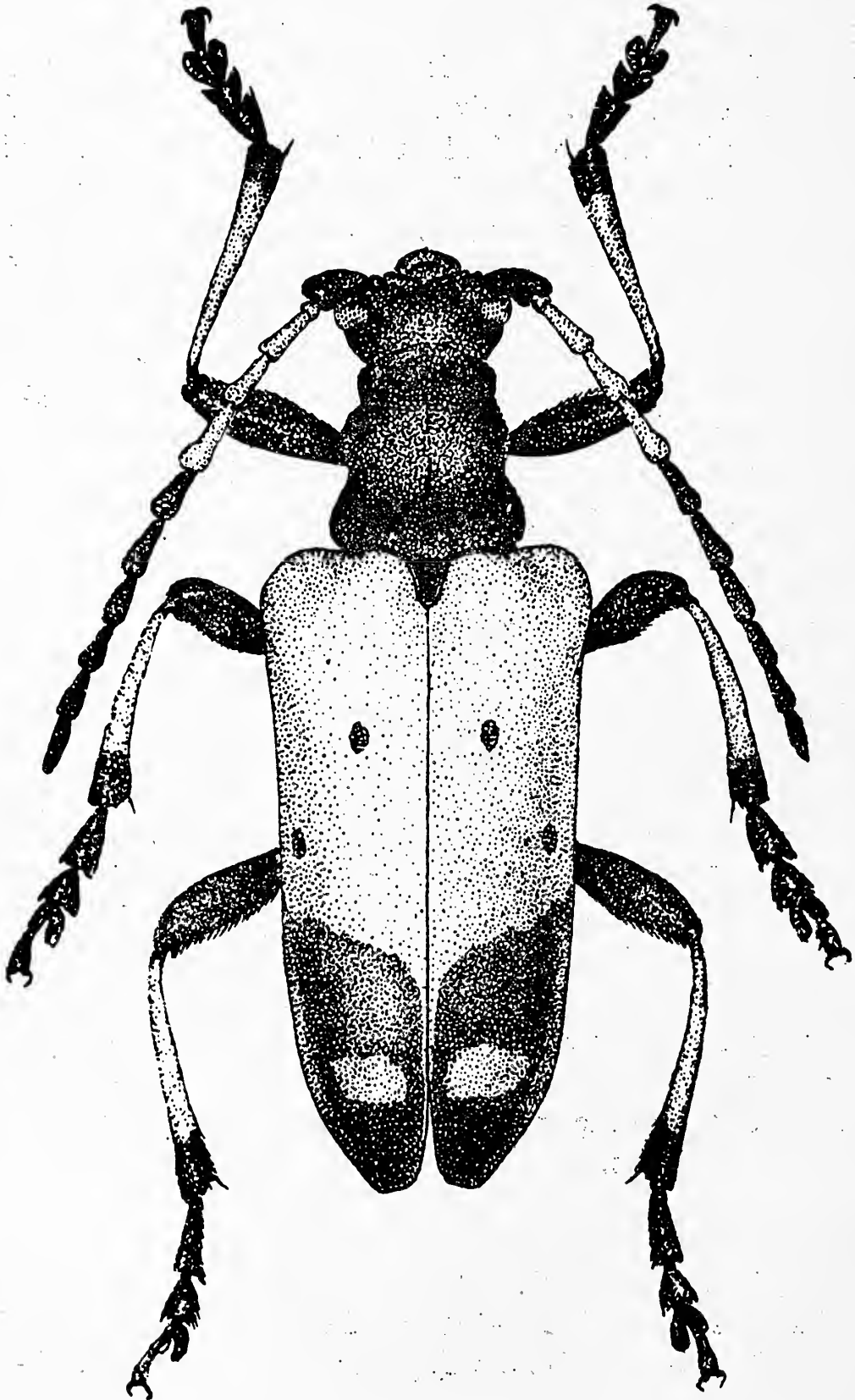
with full crowns. They live for three to four weeks, mate on maturation of gonads, and oviposit in soil around roots of herbaceous vegetation. In gardens the female prefers the roots of peonies (*Paeonia anomala*) for oviposition, then spurge (*Euphorbia pilosa*), and less so roots of Siberian globe flower (*Trollius asiaticus*). Female oviposits repeatedly and in between egg laying appears on plants for feeding and mating. One female can lay up to 44 eggs.

The incubation period varies from 19 to 35 days, on the average 22.8 ± 0.06 days. Larvae appear end of June and in July. En masse hatching in foothill regions is evident in first half of July, and in high-altitude alpine areas end of July and early August. After hatching larvae bore into plant roots and feed on their tissues. They largely inhabit roots of peonies, rarely those of spurge and other plants. In Salair, during excavations in July, 21 young larvae were found on one root of peony and 27 on another. At the end of September nine roots of peonies were dug up and 28 II-instar larvae found on them. As many as seven larvae were found on one plant. Larvae of this species very rarely settle on spurge. In Altai larvae were found in the alpine range (Kolyushtu) on golden root (*Rhodiola rosea*). Soil moisture at these larval habitats is comparatively high, from 20 to 42%. Larvae cut small openings or holes in roots and sometimes make comparatively long meandering galleries. Second- and III-instar larvae quite often emerge from roots, move into soil, and apparently feed on fine rootlets. Before hibernation larvae weighed 79.4 to 248 mg, average 177.3 mg. During overwintering they lost up to 3.5% or more weight. However, the condition of larvae depends considerably on soil moisture. In air-dried soil larvae rapidly lose moisture and their weight decreases by almost half (42.5%) in a short period (24 hrs). In moist soil weight is gradually restored, which indicates the significant level of permeability of the larval cuticle. In spring mature larvae make spacious cells in soil, with well-polished inner walls, and pupate in them. Length of cell 12 to 14 mm, width up to 10 mm. Pupal development at 18 to 20°C takes 17 to 20 days. Emergence of beetles from soil is completed in the second half of May and early June. Weight of larvae before pupation 156 to 262 mg, average 208.5 mg, pupae 125 to 233 mg, average 183.8 mg, and beetles 82 to 167 mg or more, average 132.4 mg. Life cycle completed in one to two years.

2. *Brachyta bifasciata* (Oliv.)

Olivier, 1792, *Enc. Meth.*, vol. 7, p. 520 (*Leptura*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 188-191 (*Evodinus*); Cherepanov and Cherepanova, 1971, *Nov. i maloizv. vidy fauny Sibiri*, vol. 4, pp. 73-78 (*Evodinus*).

Adult (Figure 52): Body large and stocky. Head elongate behind eyes, transversely convex in region of frons between antennae, flat between upper lobes of eyes, with flat minute rugulose punctation, and matte. Eyes convex, inner side with small notch. Apices of antennae barely cross middle of elytra in male and do not reach this level in female; 1st segment thick, with large dense punctation, more elongate and bent under in female, short and straight in male.



Pronotum anteriorly with broad flange, basally with transverse groove; laterally produced into broad tubercle; base and posterior rounded angles broadly flattened; with dense minute rugulose punctation; and median longitudinal groove (sometimes with smooth band instead). Scutellum triangular, with fine dense punctation. Legs moderately long, femora comparatively thick, hind tarsi considerably shorter than tibiae, thick.

Elytra wide and convex, at humeri 2.0 times wider than pronotum; humeri project, narrow insignificantly from base toward apex, rounded apically; with very minute punctation and short indistinct hairs. Body black. Antennae at base (except 1st dark brown segment) light yellow, at tip dark brown. Tibiae yellow, apically darkened; tarsi and femora black. Elytra straw-yellow, at apex black, before hind clivus with transverse black band not reaching suture but joining laterally with black apex; anterior half with three minute black spots forming triangle, one each on disk and two laterally. Length of body 17 to 24 mm.

Egg: Fusiform, narrows markedly toward both poles, and narrowly rounded, almost pointed at ends; with green tinge. Chorion with fine cellular sculpture, surface somewhat rough. Length 2.8 mm, width 0.8 mm.

Larva (Figure 53): Readily distinguished from larvae of other species of this genus by sparse hairs and shape of apical spine on abdominal tergite IX. Body thick, massive. Half of head retracted into prothorax, narrowly rounded anteriorly, dorsally flattened. Epistoma coarsely striate transversely, triangular, pointed backward, bound laterally by whitish, in posterior half slightly concave frontal sutures (sutura frontalis), and medially divided by longitudinal dark brown suture (sutura medialis); anterior to posterior white transverse band with one deep alveolar puncture seen paramedially. Hypostoma smooth, medially divided by narrow white longitudinal band. Clypeus somewhat trapezoidal, length 0.25 width at base. Labrum broad, anterior margin obtuse or broadly rounded, and with long setae. Mandibles massive, apically obliquely truncate, on inner side with small ridge parallel to truncate margin. Prothorax thick, not wider than subsequent segments.

Pronotum transverse, medially glabrous on anterior margin, laterally with sparse setaceous hairs forming narrow transverse band. Similar hairs seen on posterior angles. Abdomen narrows slightly posteriorly, with almost parallel sides, with very long hairs laterally. Dorsal locomotory ampullae slightly convex, divided by transverse grooves, and consist of two carinae; anterior one small and posterior one very large, with five to seven short lateral setae. Abdominal tergite VIII in anterior half glabrous, on posterior margin and laterally with sparse setaceous hairs. Tergite IX short and transverse, posteriorly with large

- 120 triangular projection, sclerotized laterally, with semicircular sclerotized spine at end. Disk of tergite IX with four setae forming transverse row, six setae (three setae on each side) at apex of triangular projection at base of spine. Sternite VIII on posterior margin and laterally, and sternite IX on posterior margin, with sparse setaceous hairs forming transverse row. Body white. Head reddish-rust. Mandibles black. Pronotum on anterior margin and laterally with yellowish-rust transverse band interrupted by narrow white clearance in middle. Length over 25 mm, width of head 3.5 to 4.0 mm.

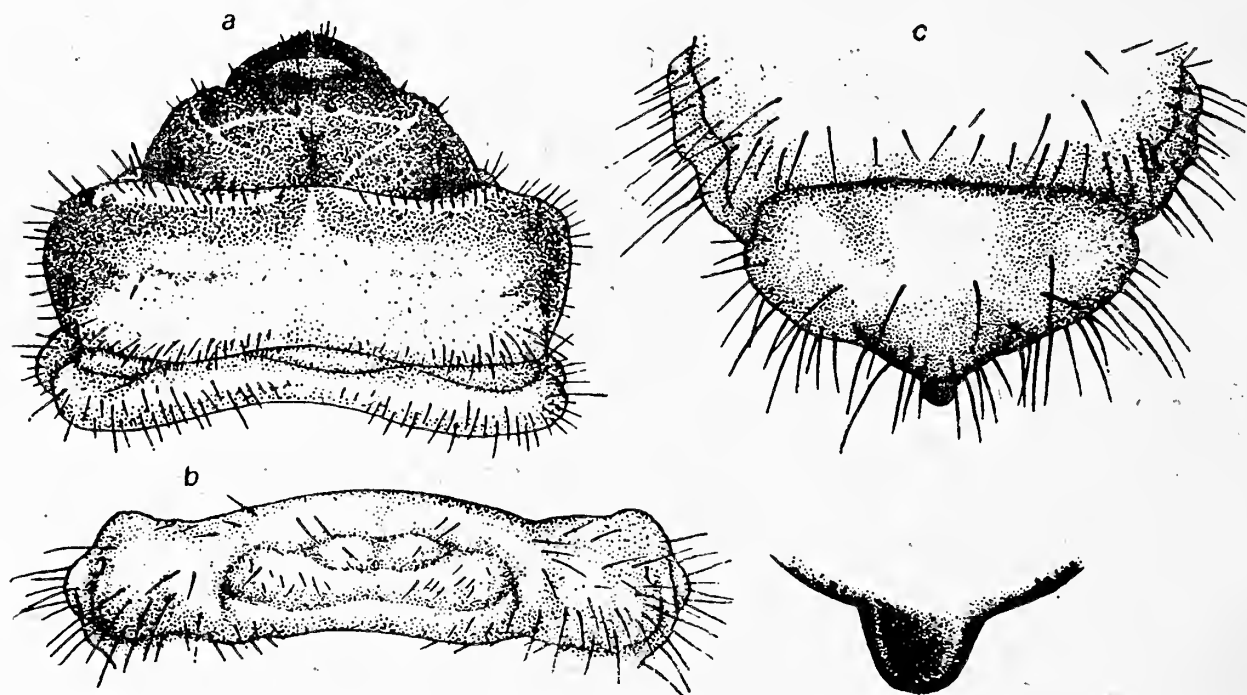


Figure 53. Larva of *Brachyta bifasciata* (Oliv.).

a—head and pronotum; b—abdominal tergite with locomotory ampulla; c—tip of abdomen.

Pupa (Figure 54): Similar to pupa of *Brachyta interrogationis* (L.). Differs in glabrous (on disk in region of anterior flange) pronotum and faint tubercular elevation on abdominal tergite V. Body stocky, C-shaped. Head bent under, notably elongate, with longitudinal suture on vertex, between antennae with transverse prominence. Antennae arcuate, dorsally curve around midfemora.

Pronotum in anterior half with broad deep flange, on disk transversely rugose, in region of flange and elsewhere on disk glabrous, without setae, on posterior and anterior raised margins with dense setae forming continuous transverse band. Only sometimes (in male) stray setae, forming faint transverse row, visible. Mesonotum with two insignificant and metanotum with two distinct produced tufts of piliform setae.

- 21 Abdomen narrows posteriorly. Abdominal tergites with median longitudinal groove, alongside which in each of first five segments one

paramedial tubercular protuberance occurs, covered with dense rusty setaceous hairs forming paired tufts. Rest of tergites without tubercular protuberances, in posterior half with sparse hairs that do not form tufts. Abdominal sternites in male with minute sparse hairs laterally. Tip of abdomen with small triangular spinule. Length 15 mm, width of abdomen 6.0 mm.

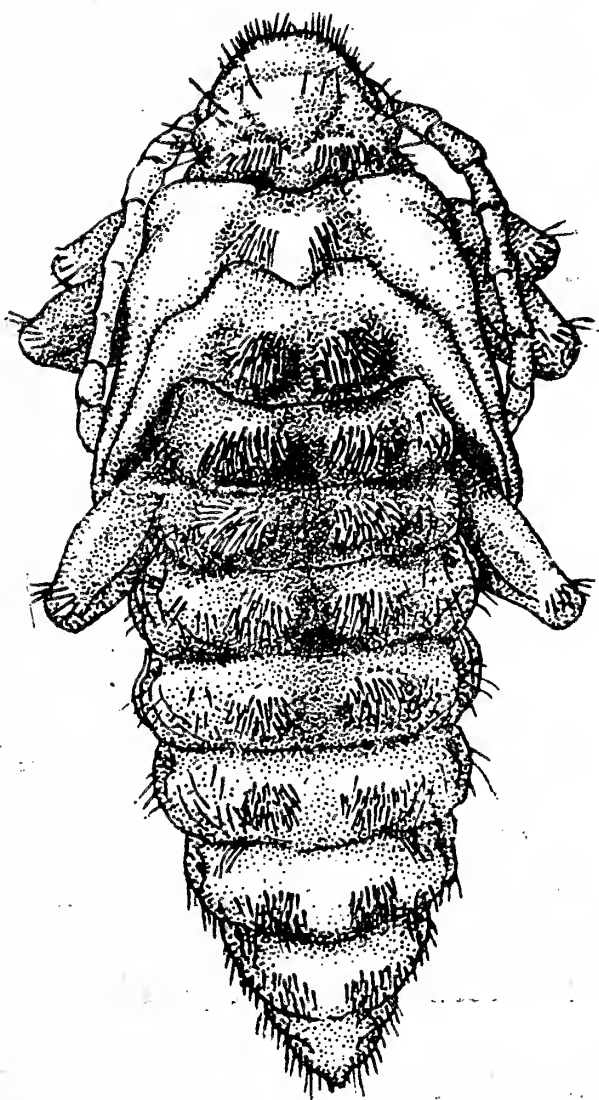


Figure 54. Pupa of *Brachyta bifasciata* (Oliv.).

Material: Collected in Ussuri-Primor'e region. Adult insects 37, larvae 26, pupae four.

Distribution: Eastern Siberia from Yablonov range (south) to Pacific Ocean coast; Japan, Korea, and northern China. Abundant in Ussuri-Primor'e region.

Biology: *Brachyta bifasciata* (Oliv.) is ecologically associated with herbaceous vegetation. Inhabits coniferous and broad-leaved forests. Beetles sighted in June up to August. Seen on flowers of Umbelliferae, Rosaceae, and other plants. Found in large numbers on peonies (*Paeonia*). They feed on flower petals, gather pollen, and mate on these plants per se. Female lays eggs in soil or forest undergrowth near roots, or in

basal zone of stalks of peonies (possibly of other plants also). Eggs laid in June and July. Observations in nature revealed that the incubation period at 16 to 20°C continues for 20 to 36 days, average 22.7 ± 0.1 days; 171 larvae hatched under these conditions.

Hatching larvae are quite mobile; they move rapidly, penetrate the soil, and bore into plant roots. Galleries initially made under cork layer and later deeper into soft tissue. Growth rate of larvae significant. Immediately after hatching they weigh about 1.0 mg. In 70 to 80 days, before overwintering, their weight has increased to 17.0–414.5 mg, average 176.1 mg. During hibernation they are in a state of dormancy and their weight decreases considerably. For example, three larvae before overwintering weighed 1,097 mg, and after 79 days of overwintering had lost 279.2 mg, i.e., 25.4% of their original weight. After hibernation larvae feed and grow rapidly. Thus two larvae before hibernation weighed 131.2 mg and 50 days after emergence from winter diapause 715.3 mg, i.e., weight increased during this period 5.4 times. Weight increase is maximum in young larvae living on fresh succulent roots of peonies and least in those living on dried roots of dead plants. For example, the weight increase in larvae hatching from eggs laid simultaneously under laboratory conditions and living for 106 days on succulent fresh roots of peonies, was 296 to 414.5 mg, while that of larvae maintained on roots of dead plants was only 96 to 135 mg.

Third-instar larvae emerge from roots, make pupal cell in soil, and pupate in it. Length of pupal cell 20 to 23 mm, width 6.0 to 10.0 mm. Pupation observed in May and June. Beetles appear end of May and in June, emerging from soil mainly in June. During metamorphosis the weight of these insects falls by 26.6%. Life cycle completed in two years. Larvae are often seen on roots of peonies.

3. *Brachyta variabilis* (Gebler)

Gebler, 1817, *Mem. Soc. Nat. Moscou*, vol. 5, p. 320 (*Pachyta*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 192–197 (*Evodinus*); Cherepanov and Cherepanova, 1971, *Nov. i maloizv vidy fauny Sibiri*, vol. 4, pp. 17–27 (*Evodinus*).

Adult (Figure 55): Distinguished by black suture on elytra and structure of antennae in male. Body massive, moderately elongate. Head 122 comparatively short, deeply and transversely compressed anterior to antennal base; with dense punctation. Antennae of female do not reach beyond middle of elytra and produced on outer distal margin from 5th to 10th segments; 11th segment (male) with distinct flange.

Pronotum slightly elongate, in anterior third with broad flange, basally with transverse groove, laterally produced into large spine, with bulging disk, sometimes with median longitudinal smooth band; with

dense deep punctation and short sparse hairs that usually do not form continuous cover. Scutellum longitudinally elongate, pointed or narrowly rounded at apex; with dense punctation.

Elytra convex, with parallel sides, narrow in posterior fourth; with minute punctation and short tender hairs that do not form continuous

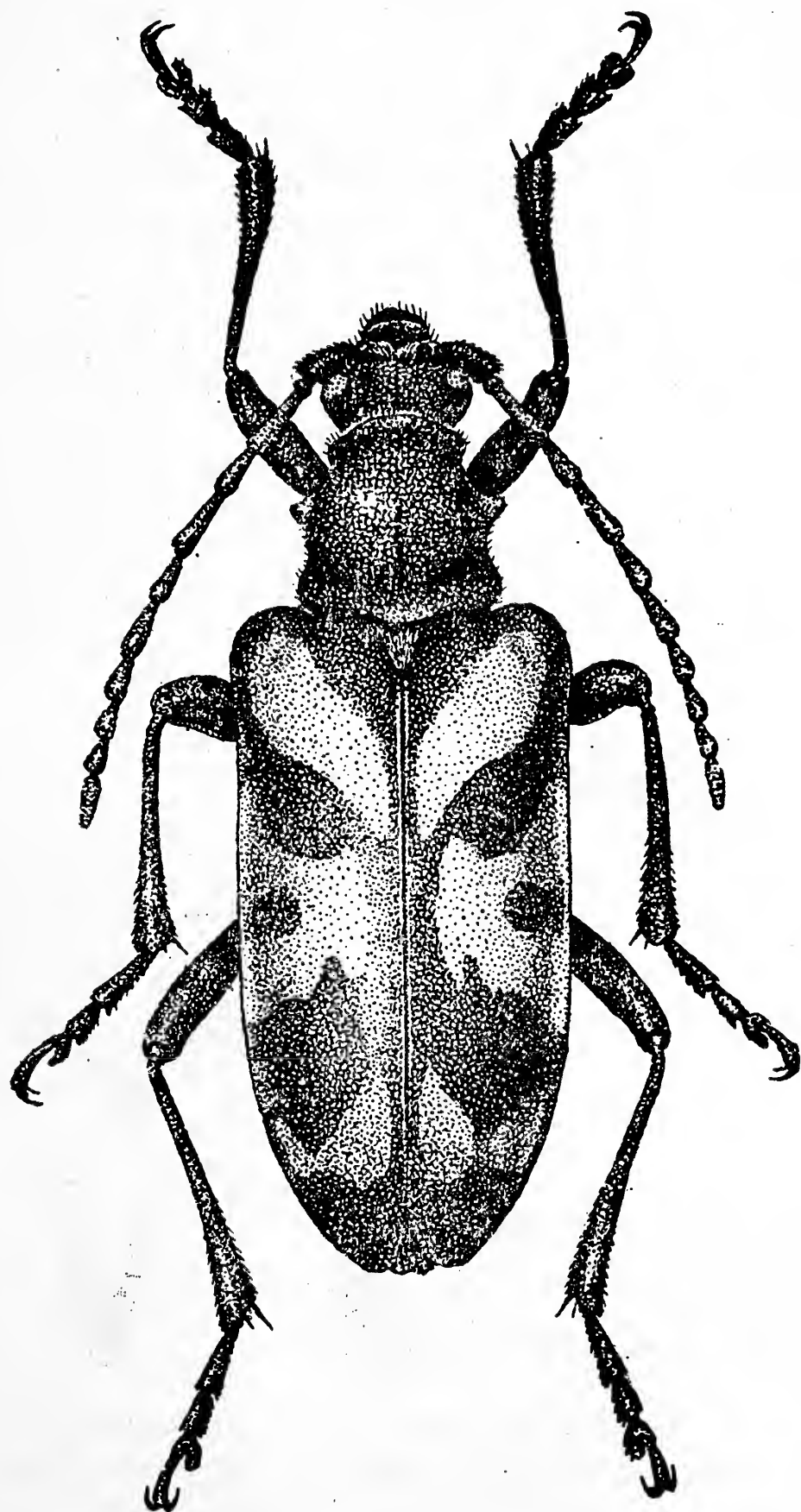


Figure 55. *Brachyta variabilis* (Gebler).

cover. Body black. Antennae blackish-brown, sometimes rusty at base or apex, often entirely rusty. Legs black, tibiae sometimes rusty, rarely
 123 entirely rusty. Elytra straw-yellow, with black spots and blackened suture. Sometimes dark coloration so prominent that only light-colored minute spots visible against black background. Often elytra uniformly black or red. Some 100 variations are known for elytral coloration. In my collections from different regions of Siberia, insects with variegated elytra (ab. *lateronotatus* Plav., f. *typica*, ab. *subconstrictus* Plav.; from Plavil'shchikov, 1936) constitute 64.7%, those with black elytra (ab. *constrictus* Germ.)—22.8%, and those with red elytra (ab. *semifulvus* Pic)—12.5%. However, in high-altitude regions melanism prevails. Thus of the 59 beetles collected from Altai (Artybash) from spurge, those with variegated elytra constitute 29.4%, black elytra—45.1%, and red elytra—25.5%. Length of body 10 to 20 mm.

Egg: White, with greenish tinge, elongate, narrowly rounded at poles, with fine cellular sculpture. Cells pentagonal, septa between them narrow, matte. Length 2.8 mm, width 0.9 mm.

Larva (Figure 56): Readily distinguished by long apical spine of abdominal tergite IX, structure and pubescence of dorsal locomotory ampullae, and other features. Body thick, with almost parallel sides. Half of head retracted into prothorax and remainder notably bent downward. Epistoma (frontal plate) triangular, comparatively smooth,

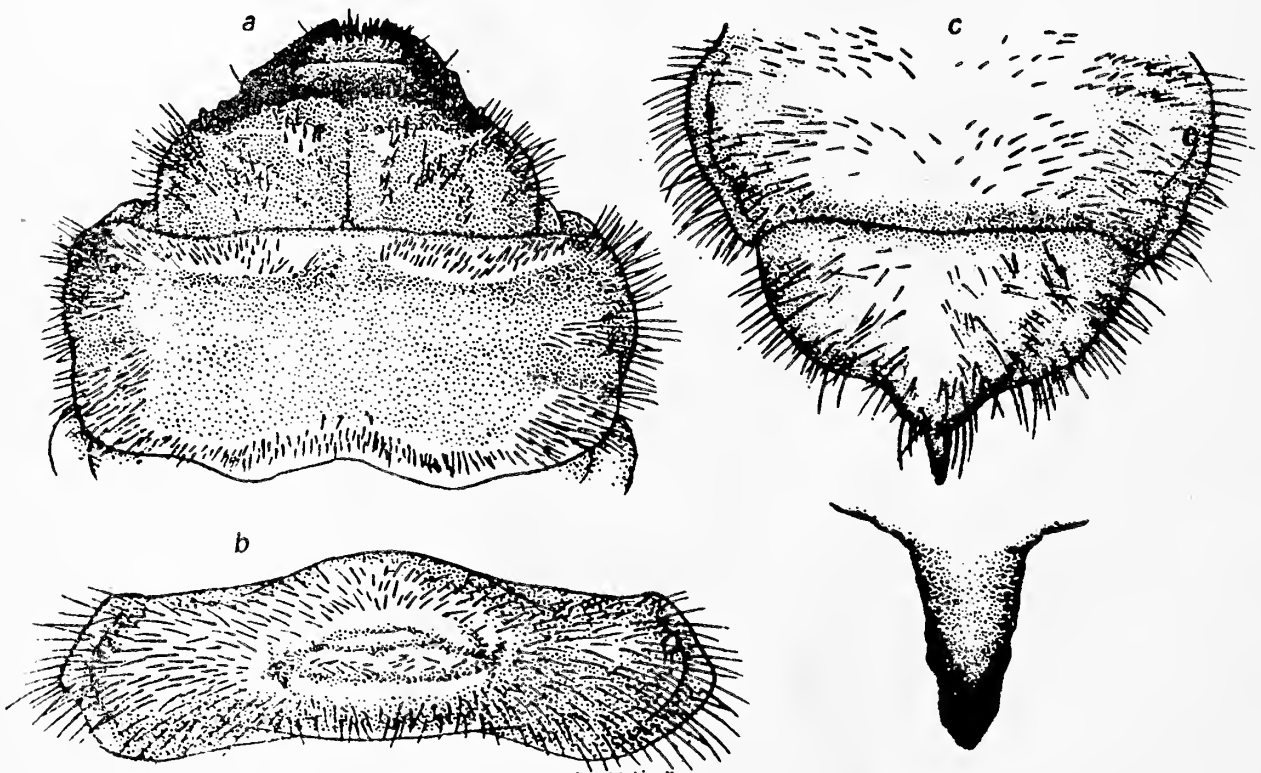


Figure 56. Larva of *Brachyta variabilis* (Geb.).

a—head and pronotum; b—abdominal tergite with locomotory ampulla; c—tip of abdomen.

with just a few faint wrinkles, bound laterally by white frontal sutures; posterior half medially divided by brownish longitudinal suture and anterior to middle by transverse white band, in front of which two alveoli occur. Parietals in anterior half with sparse setaceous hairs. Hypostoma flat and markedly narrows anteriorly. Clypeus transversely trapezoidal, markedly narrows anteriorly. Labrum broad and convex, broadly rounded in front, with sparse setae on anterior margin and along sides.

Pronotum broadens somewhat anteriorly, on disk slightly convex, on anterior margin with broad transverse pubescent field in front of rusty band, and short, sometimes dense hairs laterally and at posterior angles. Pronotal shield glabrous, laterally without longitudinal folds, basally with short setae forming transverse row. Eusternum bulges, with
124 numerous uniform hairs. Thoracic legs developed, pubescent, with pointed, slightly sclerotized claws.

Abdomen with short dense hairs. Dorsal locomotory ampullae divided by transverse grooves into two transverse carinae, the posterior one with short dense hairs. Ventral locomotory ampullae divided by transverse groove, with two rows of granules on which more or less projecting minute chitinized granules form shagreen sculpture. Tergites VIII and IX entirely covered with dense long hairs. Tergite IX markedly produced posteriorly into long sclerotized spine at end; spine basally circular in cross section, notched dorsally at apex, and 2.0 to 2.5 times longer than wide. Tip of abdomen densely pubescent on ventral side. Anal lobes entirely covered with dense setaceous hairs. Body white, head rusty, mandibles black. Pronotum on anterior margin with yellow transverse band that significantly broadens laterally. Length of body up to 25 mm, width of head up to 3.5 mm.

Pupa (Figure 57): Characterized by absence of sharp transverse striation on meso- and metanota, and dense setaceous cover on abdominal tergites VIII and IX. Body large and thick, notably curved ventrally. Head narrow, bent under, with thin setae around base of antennae along inner side and behind them close to vertex. Antennae curve round mid-femora, with apices flexed to sides of body.

Pronotum narrows anteriorly, with broad flange in anterior third, large tubercle laterally, in posterior third in female sometimes with deep median longitudinal groove, anterior raised margin with straight, very broad setaceous band, posterior margin with double, concave, anteriorly narrow setaceous band; disk with faint transverse striation and entirely covered with sparse thin acicular setae. Mesonotum with indistinct transverse striation and short setae forming two medial tufts. Metanotum in anterior half with thin transverse striation and pair of large tubercular protuberances behind middle densely covered with setae.

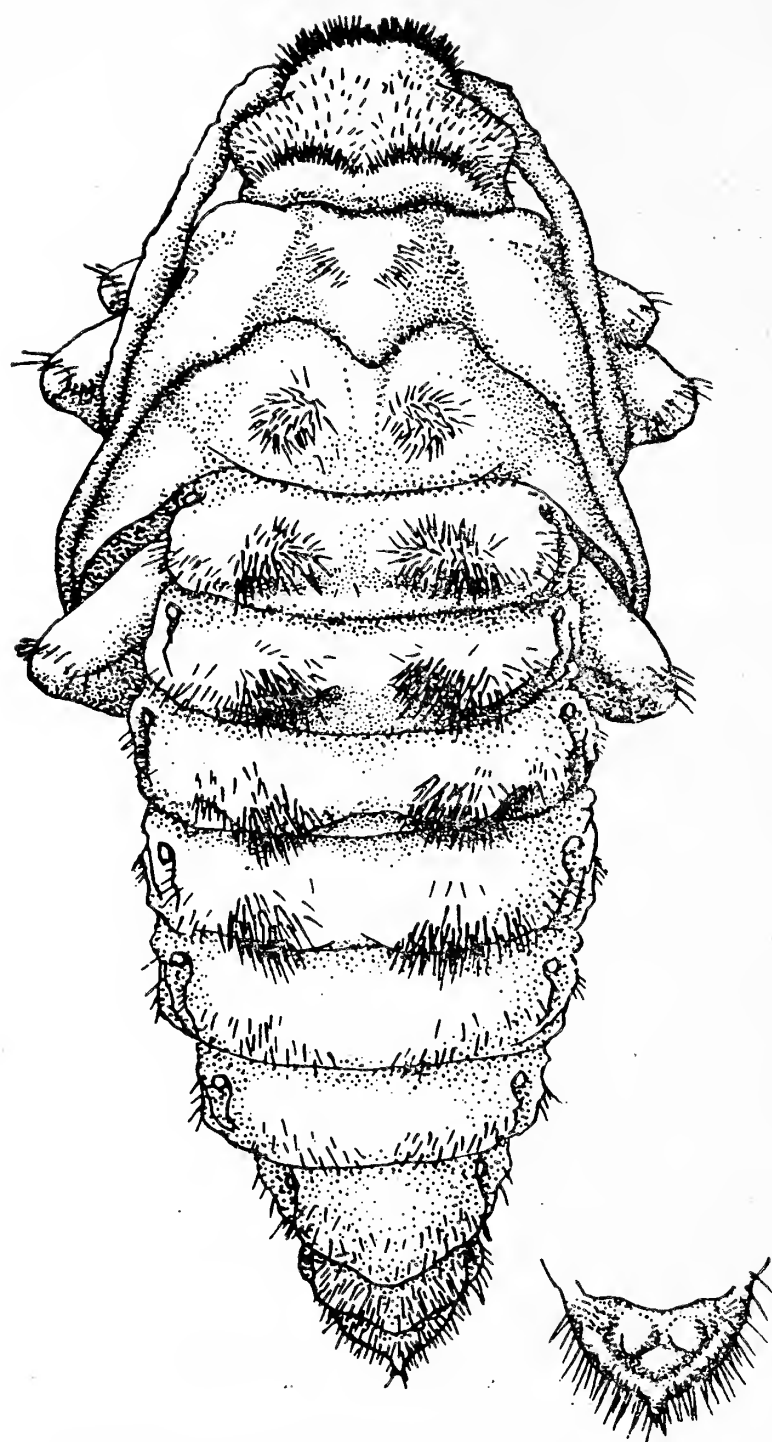


Figure 57. Pupa of *Brachyta variabilis* (Geb.).

Abdomen markedly narrows posteriorly. Abdominal tergites I to IV with paired densely setaceous prominences that form two longitudinal rows together with metathoracic ones. Abdominal tergites V to VII smooth, with short piliform setae. Abdominal tergites VIII to IX (especially in female) entirely covered with dense long setae. Spine at tip of tergite IX minute and nonsclerotized. Tip of abdomen bound ventrally by horseshoe-shaped ridge posteriorly produced angularly and set with many tender piliform setae. Valvifers of female small, hemispherical, moderately separated. Length of body 14 to 25 mm, width of abdomen up to 7.0 mm.

Material: Collected in Altai, Ob' region, central Yenisey, Tuva,

Baikal region, Yakutia, Kolyma, Trans-Baikal, and Ussuri-Primor'e region. Adult insects 1,553, including 60 raised in the laboratory, larvae 88, pupae 12. Most abundant in mountain forests of Altai, the Sayans, and Baikal region.

Distribution: From western Ural region and the Urals to Pacific Ocean coast; northern Mongolia.

Biology: Inhabits the taiga zone, northern forest-steppe and mountain forest belts. Ecologically associated with herbaceous vegetation of forests. Quite often sighted in hills up to a height of 2,000 m above sea level. Large number of beetles sighted in last five days of May and early June, with sightings continuing to last 10 days of July. Feed on flowers of Umbelliferae, Rosaceae, and other plants, eating petals, and especially pollen. Gonads mature during feeding and after mating female oviposits on roots of herbaceous vegetation. Beetles mainly colonize spurge (*Euphorbia pilosa*), rarely other plants. One female can lay more than 40 eggs in her lifetime. Eggs mainly laid in June, some (late ones) in July. Incubation continues for 21 to 39 days, average 27.1 days.

Young larvae usually colonize young roots, penetrate under cork layer, and feed on soft tissue. After their first summer larvae weigh up to 43.6 to 102.5 mg. Let it be noted here that larvae grow twice as fast on roots of spurge than on roots of peonies. This is an indication of the ecological affinity of the species. In Altai near Artybash 115 larvae of *B. variabilis* (Gebl.) were found on spurge and none detected on the roots of peonies. The latter were inhabited by the larvae of *B. interrogationis* (L.). In Tuva (mountains close to Teli) many larvae of *B. variabilis* (Gebl.) were found in grass turf and on leguminous plants, and some young larvae were even found on legume pods. In autumn, when the temperature falls to 6.0°C, larvae remain in a state of cold torpor and during hibernation lose weight. In spring, with the onset of warm weather, they feed once again on root tissues, biting large holes in the roots, and grow comparatively rapidly.

Third-instar larvae emerge from roots, make pupal cell alongside them in soil, and polish (tamp) its inner walls. Length of pupal cell 20 mm, width 10 mm. Some larvae pupate at end of August, others in early September. Beetles emerge from pupae in second half of September but overwinter in pupal cell. Most of population overwinters in larval stage and pupates with the onset of warm weather in May. In 1975 in Altai, of the 115 larvae extracted from cells eight pupated in autumn. The rest overwintered. Soil temperature at a depth of 5.0 to 20.0 cm dropped in winter to -0.1 to -1.2°C, warming up in April to +1.6°C and above.

Pupae maximum in May, and adult insects emerge from them in

Table 4. Weight variation (mg) in *Brachyta variabilis* (Gebl.) during metamorphosis (based on data of 1975-1976)

Sex	No. of insects	Larvae		Pupae		Adult insects	
		Average	Range	Average	Range	Average	Range
Male	30	326.3±11.1	172-449	269.6±10.0	139.5-393.0	198.2±7.9	92.5-294.0
Female	29	467.6±23.8	264-708	380.6±20.5	219.0-593.0	295.1±15.5	151.5-445.0

second half of this month; however, beetle emergence from soil commences in last 10 days of May and ceases in first half of June. The first to emerge are those beetles which developed in autumn, followed by those of the spring generation. Generally beetle emergence from soil commences when plants are in full bloom, which attracts the insects. Weight of larvae entering cells for pupation 132 to 708 mg, average 126 393.6 mg; pupae 118 to 637 mg, average 373 mg; and beetles 92.5 to 598.0 mg, average 341 mg. Females are markedly larger. Life cycle usually completed in two years; II- and III-instar larvae hibernate; adult insects may also hibernate as a rare exception.

4. *Brachyta eurinensis* (Tsher.)

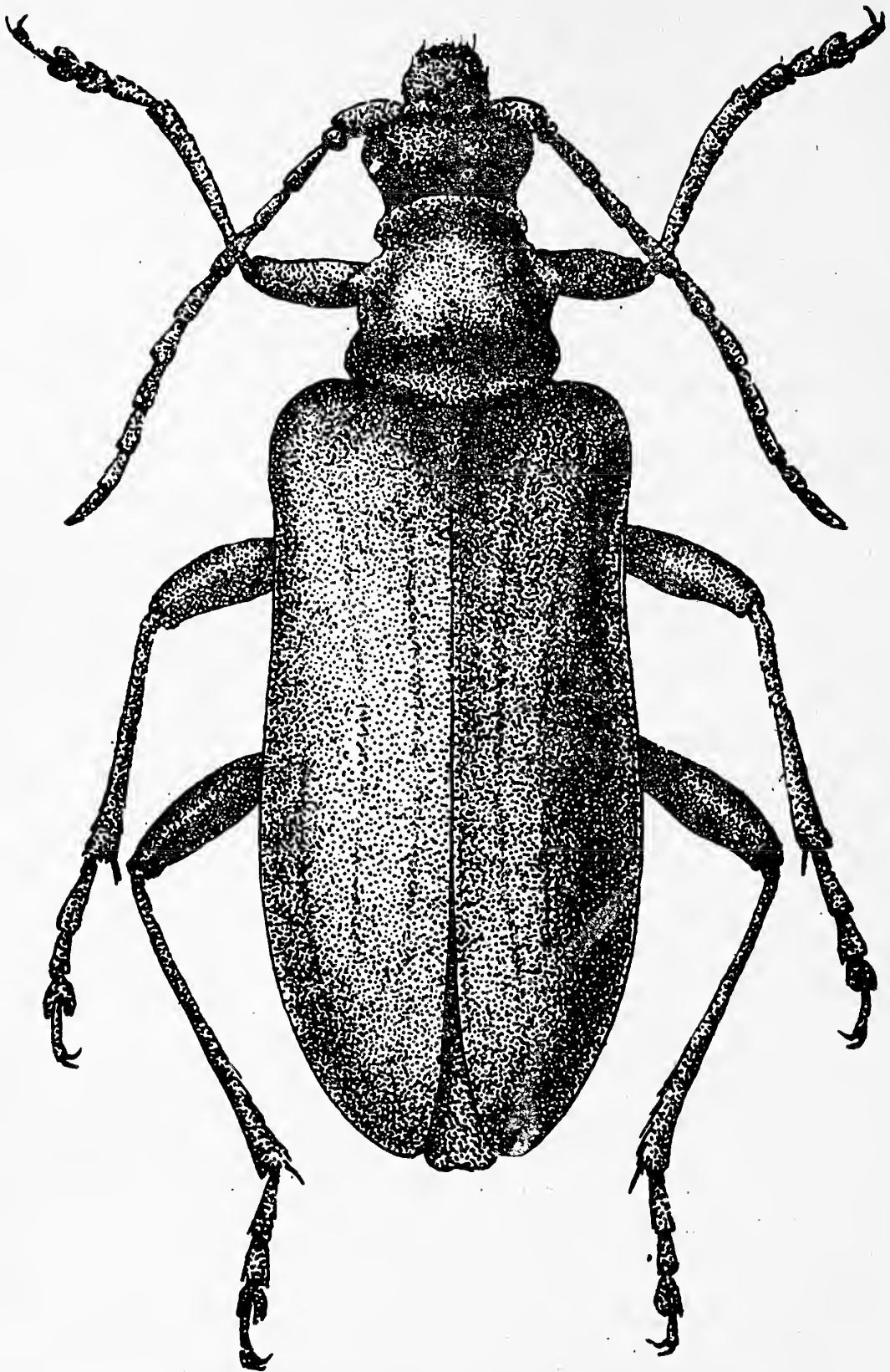
Cherepanov, 1978, *Taksonomiya i ekologiya chlenistonogikh Sibiri* (Nov. i maloizv. vidy fauny Sibiri), p. 58 (*Evodinus*).

Adult (Figure 58): Close to *Brachyta variabilis* (Geb.) in characteristics. Differs in two projecting longitudinal ridges on elytra, body color, and very short 4th antennal segment. Body large and stocky. Head short, transversely convex between antennae, with broad transverse depression behind antennae between upper lobes of eyes, faint tubercular protuberances on occiput, gentle and insignificant narrowing behind eyes, and with dense deep punctation. Eyes convex, finely faceted, inner side slightly emarginate. Antennae short, markedly short of reaching middle of elytra. First antennal segment thick, with dense large punctation; 2nd segment short and transverse; 3rd distinctly longer than 5th; 4th barely longer than 6th but notably shorter than 5th; 11th short and pointed apically.

Pronotum not longer than wide, laterally produced into sharp conical tubercle, with deep flange anteriorly, transverse groove basally, raised margins, rounded and barely flattened angles; with dense deep punctation merging at places, median longitudinal groove, and faint sparse easily abraded hairs.

Elytra with parallel sides, somewhat compressed at humeri, rounded individually at apex, with fine dense punctation imparting matte tone, and short, barely perceptible hairs; with projecting humeri, faint longitudinal but quite distinct ridges, one on elytral disk parallel to suture, second on inner side of humeral tubercle terminating at hind clivus. Legs not long; femora moderately thickened, smooth; hind tibiae apically without deep notches, on lower margin with pair of spurs, of which inner very long, outer short. Body ventrally with minute, dense, light-colored, adherent hairs. Body, elytra, and legs rusty-brown, antennae rusty. Anterior and posterior margins of pronotum light rust. Length of body 15 mm.

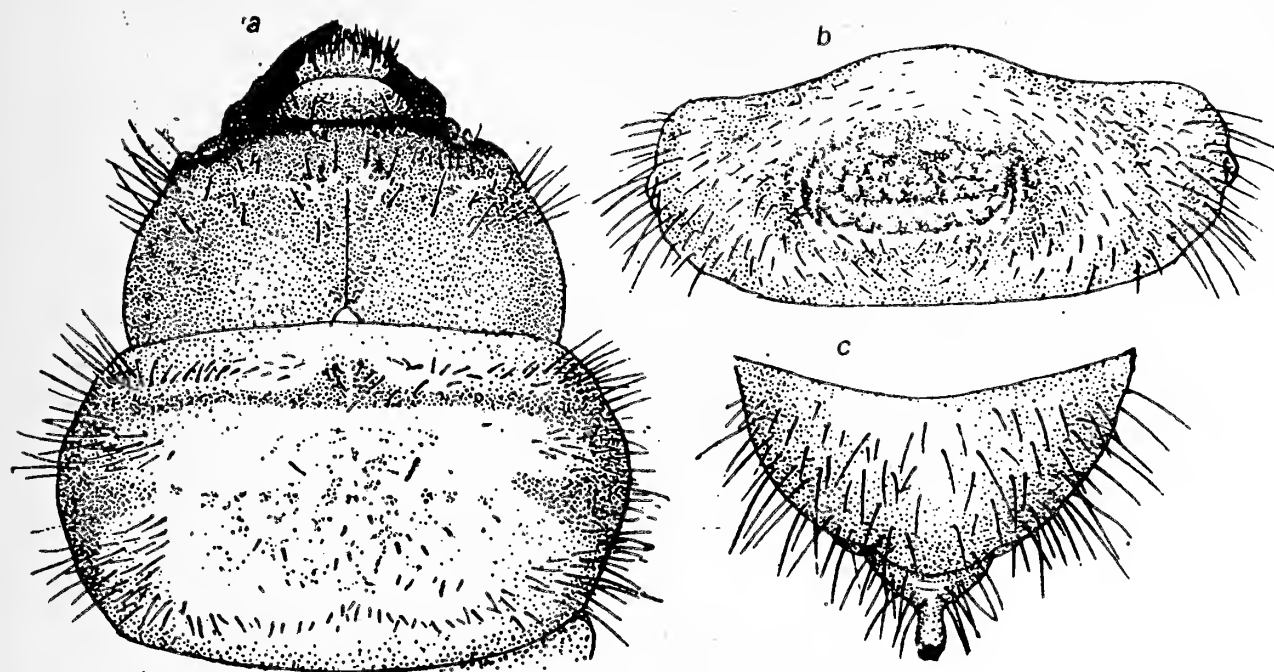
Larva (Figure 59): Characterized by less developed hair cover of



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Figure 58. *Brachyta eurinensis* (Tsher.), female.

body. Head flat, slightly rounded laterally, and with almost parallel sides. Epistoma triangular, medially slightly impressed longitudinally, bound laterally by well-developed whitish frontal sutures which, in posterior half, are somewhat concave; anterior to middle with sharp transverse white band medially interrupted, and narrow longitudinal suture resembling streak, somewhat smoothened in middle. Parietals
 127 glabrous in posterior half, with long sparse setaceous hairs in anterior



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Figure 59. Larva of *Brachyta eurinensis* (Tsher.).

a—head and pronotum; b—abdominal tergite with locomotory ampulla; c—abdominal tergite IX.

half. Hypostoma slightly convex, narrows somewhat in front, with pair of lateral setae in transverse row on anterior margin, and narrow white band in middle. Clypeus bulges trapezoidally, reddish-rust at base. Labrum transversely oval, bulges, laterally with long setae, on disk and anterior margin short setae. Mandibles elongate, obliquely truncate or somewhat notched at apex, reddish-brown, darken apically.

Pronotum transverse, slightly convex on disk, with transverse narrow yellow band in anterior third, produced forward angularly in middle, glabrous yellow area on sides, short dense hairs on anterior margin (in front of yellow band), and very sparse hairs laterally. Pronotal shield white, with rusty specks; faint thin hairs at base form narrow transverse band, without lateral longitudinal folds. Prosternum in region of proprosternum and presternum with short rusty hairs. Euster-
 128 num coriaceous, lustrous, basally glabrous. Legs short, with two segments, and with thin acicular claws.

Abdomen elongate, with tender, light-colored hairs laterally. Dorsal locomotory ampullae bulge, located on abdominal tergites I to VII, granulate, with faint transverse carina, and five or six setae on each side of longitudinal groove. Ventral locomotory ampullae with two transverse rows of granules. Abdominal tergite IX laterally with dense, on disk sparse yellow hairs; produced posteriorly into long sclerotized spine bent downward. Length of body up to 25 mm, width of head 3.5 mm.

Material: Collected from Shakhtamy in Trans-Baikal and Tuva. Adult insects two, larvae five.

Distribution: Southern Siberia, from upper reaches of Yenisey to Shilka.

Biology: Colonizes herbaceous associations in forests. Reaches up to 1,000 m in mountains. Larvae live in turf. Found near Barlyk on southern slope of forests among mixed grasses, including *Koeleria cristata*, *Carex pediformis*, *Colurix geoides*, *Astragalus adsurgens*, *Bupleurum multinerve*, *Veronica incana*, and others. Pupates in soil at a depth of 8.0 to 10.0 cm. Pupal cells horizontal under turf. Young beetles sighted in June–July. One beetle found in soil on July 17. Flight of beetles commences in June. Found sporadically.

7. Genus *Evodinus* LeConte

LeConte, 1850. *J. Akad. Philad.*, 1, 2, 325; Plavilstshkov [Plavil'shchikov], 1915, *Rev. Russ. d'Entom.*, vol. 25, pp. 354–382; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 186–188; Gressit, 1951, *Longicorn Beetles of China*, vol. 2, pp. 60–62; Linsley and Chemsak, 1972, *Cerambycidae of North America*, vol. 6, pp. 70–72; Cherepanov and Cherepanova, 1977, *Taksony fauny Sibiri (Nov. i maloizv. vidy fauny Sibiri)*, pp. 38–46 (*Evodinellus*).

Well distinguished from the genus *Brachyta* by morphological features in all developmental stages and ecological characteristics.

Adult: Pronotum elongate, produced into small tubercle laterally, broad flange in anterior third, transverse groove at base, with bulging
129 disk, median longitudinal groove or smooth short band, and dense minute punctation. Hind tarsi thin, shorter than tibiae; 1st tarsal segment narrow and distinctly longer than two successive ones together.

Larva: Body somewhat flat, abdominal tergite IX with long spine posteriorly. Pronotal shield basally with dense minute sclerotized spinules forming transverse, on anterior margin digitate interrupted rusty band.

Pupa: Body elongate; abdominal tergites without tubercular prominences, with long piliform setae in posterior half. Larvae develop under bark of decaying and freshly fallen coniferous trees. Pupate in soil.

This genus comprises four species, of which one (*Evodinus clathratus* F.) is found in the mountains of Europe (Carpathians, Alps), another [*Evodinus borealis* (Gyllh.)] in Eurasia, and two (*Evodinus monticola* Rand. and *E. lanhami* Levis.) in North America. Their morphological features in the adult stage (body narrow, pronotum longitudinal, 1st segment of hind tarsi thin and long) correspond to those of the subgenus *Evodinellus* Plav., but are totally incompatible with the genus *Brachyta* (see above).

The genus *Evodinus* (= *Evodinellus*) evolved in close association with

conifers (*Picea*, *Abies*, *Pinus*) roughly in the post-Tertiary period, possibly in the mountain-taiga formations of eastern Siberia and Altai. Later, together with coniferous forests, this genus covered Eurasia and North America, and presently colonizes mainly mountain-taiga regions. This genus was first described in North American fauna.¹

Type species: Leptura monticola Randal, 1838.

1. *Evodinus borealis* (Gyllh.)

Gyllenhal, 1827, *Insect. Suec.*, 1, 4, 36 (*Leptura*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 203–204; Kojima and Hayashi, 1969, *Insect Life in Japan*, vol. 1, p. 11; Cherepanov and Cherepanova, 1977, *Taksony fauny Sibiri (Nov. i maloizv. vidy fauny Sibiri)*, pp. 38–46 (*Evodinellus*).

Adult (Figure 60): Body small and elongate, with almost parallel sides. Head produced in front of eyes, genae parallel and long; frons bulges between antennae, wartlike, medially with longitudinal, sometimes faint groove; vertex and occiput with dense minute punctation; temples slope; cervix narrow and elongate. Eyes large, bulge, slightly emarginate. Antennae thin, with apices reaching beyond 0.50 (female) or 0.66 (male) length of elytra; 3rd antennal segment distinctly longer than 5th.

Pronotum elongate, markedly narrower anteriorly than posteriorly, mediolaterally with fairly produced tubercle; in anterior third with broad gently sloping flange, at posterior margin with transverse groove; disk bulges; medially with short smooth, sometimes faint band; with dense minute punctation and short sparse adherent hairs. Scutellum elongate, triangular, finely punctate, pointed or narrowly rounded posteriorly.

Elytra bulge, parallel or narrow slightly posteriorly, with projecting humeral tubercle, apically obtuse, with dense minute punctation in which light-colored hairs do not form compact cover. Legs slender; femora broaden slightly; hind tarsi notably shorter than tibiae. First segment of hind tarsi slender, longer than two successive together. Body black. Antennae dark brown, sometimes with very light-colored, rusty apex. Legs black; tibiae of some species rusty. Elytra light rust, with varying black pattern. Suture, transverse band at base, band behind middle, band in posterior third, apex, and mark in middle of sides usually black (f. *typica*); sometimes elytra entirely light rust (ab. *fulvipennis* Plav.) or entirely black (ab. *obscurissimus* Pic). Length of body 7.0 to 10.5 mm.

¹I am grateful to Prof. Linsley and Dr. Chemsak of the University of California for sending me their publications and collection of beetles of North American species. This helped me review afresh the status of the genus *Evodinus*.

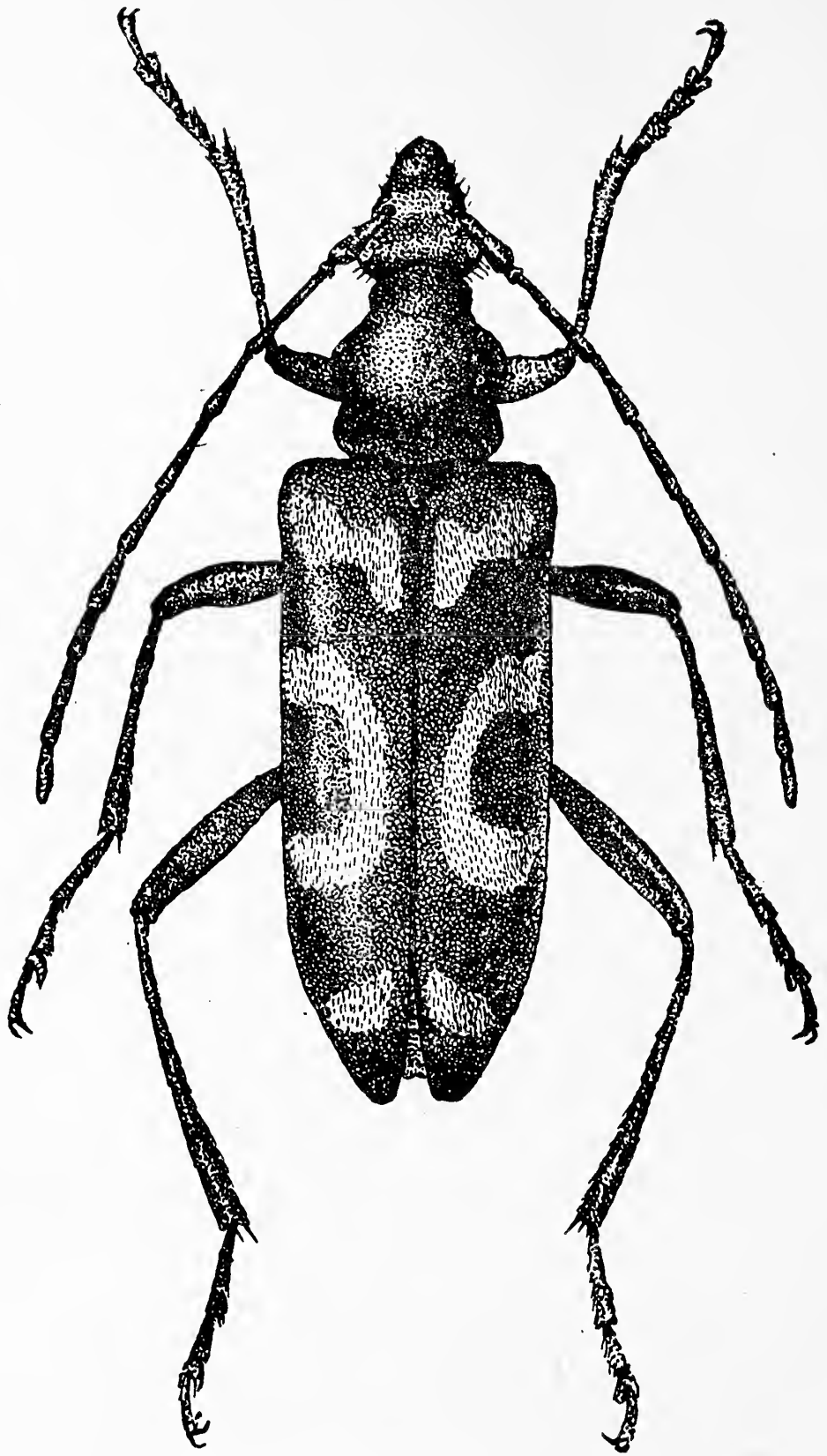


Figure 60. *Evodinus borealis* (Gyllh.).

Evodinus clathratus F., inhabiting mountain regions of southern Europe, distinctly differs from this species in reddish-rust coloration of legs (especially of femora); *E. monticola* Rand., distributed in North America, differs in dense yellowish-golden hair cover on pronotum.

Egg: Elongate, obtusely rounded at poles, silvery-white. Chorion

with cellular sculpture. Cells uneven, elongate, usually with angular pattern, with rough interstices. Length 1.2 mm, width 0.4 to 0.5 mm.

- 131 *Larva* (Figure 61): Well distinguished by spine on tip of abdomen, structure of dorsal locomotory ampullae, sclerotized base of pronotal scutum, and other features. Body flat, moderately elongate. Head transverse, somewhat retracted into prothorax, and narrowly rounded anteriorly. Epistoma (frontal plate) triangular, bound laterally by well-developed, white, somewhat curved frontal sutures, and medially divided by longitudinal brownish suture. In anterior half white transverse band and six deep pores (fossae) form transverse row that arcs posteriorly. Posterior two pores of this row, near longitudinal suture at boundary with white transverse band, devoid of setae; other pores lateral to anterior angles and with one large seta each. Hypostoma flat, narrows somewhat anteriorly, medially with narrow white band, and basally with shortened dark brown groove extending obliquely from posterior angles to midline. Parietals in anterior half with sparse long setaceous hairs. Clypeus broad, trapezoidal, smooth, and glabrous; on anterior margin with lustrous border, and here with fine longitudinal streaks in mature larvae. Labrum transverse, bulges and smooth on disk, rounded on anterior margin, with sparse setae. Mandibles thick, apically gently and obliquely truncate, with uneven surface and small carinae on inner side.

Pronotum transverse, flat on disk, slightly enlarged anteriorly, with long setaceous hairs on anterolateral margin forming distinct transverse row, medially glabrous, with long sparse setaceous hairs postero-

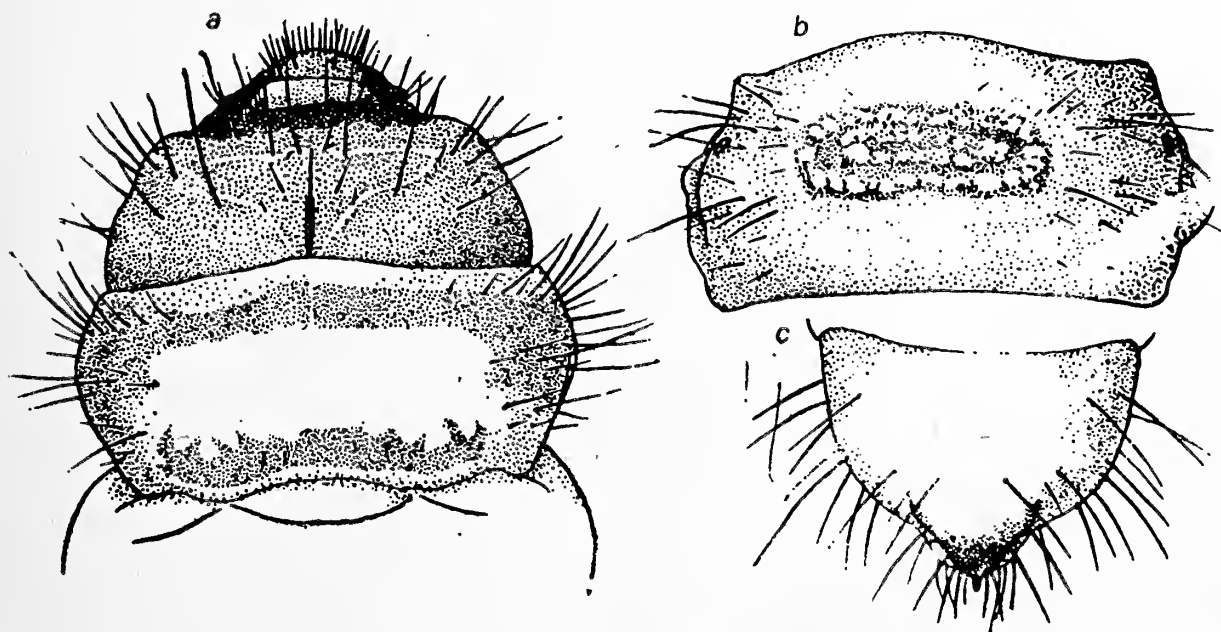


Figure 61. Larva of *Evodinus borealis* (Gyllh.).

a—head and pronotum; b—abdominal tergite with locomotory ampulla; c—tip of abdomen.

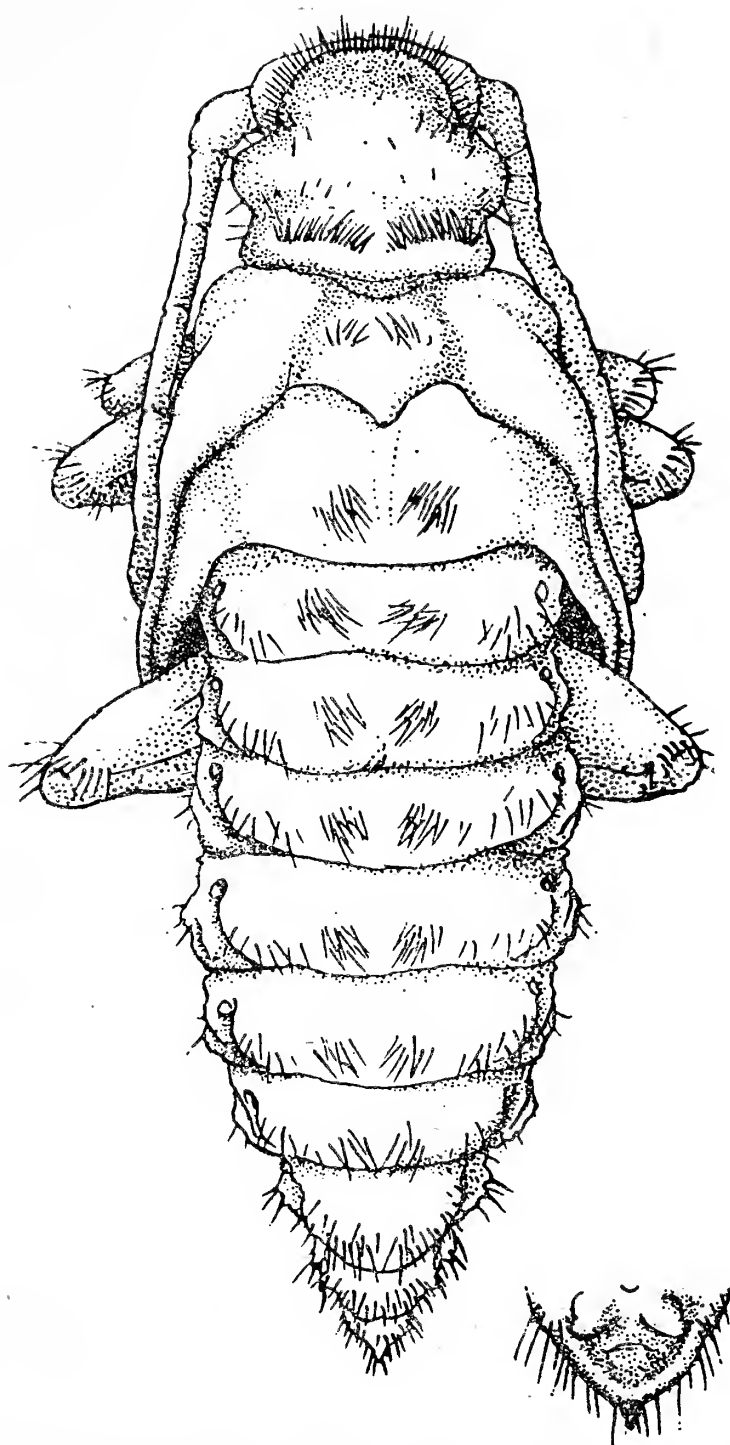
laterally. Pronotal shield without lateral longitudinal fold, glabrous, white, lustrous, basally with dense minute sclerotized spinules forming transverse rusty band, on anterior margin digitate. Meso- and metanota sclerotized on disk, with yellowish-rust transverse band. Prosternum in anterior half with sparse setaceous hairs. Eusternum triangular, well demarcated, lustrous, with long hairs apically, usually along margin. Thoracic legs well developed, with short pointed claws.

Abdomen elongate, with long dense hairs laterally. Abdominal tergites transverse, pubescent laterally, glabrous on disk. Dorsal locomotory ampullae transversely elongate, bulge insignificantly, with rather small lustrous granules forming four transverse parallel rows, of which middle rows markedly proximate. Ventral locomotory ampullae with two transverse rows of lustrous granules shifted somewhat laterally. Abdominal tergite IX produced apically and heavily sclerotized here, with sharp tubercular spinule, in posterior half with long hairs forming distinct transverse row. Abdominal sternite IX on posterior margin with long hairs forming transverse band or (especially in young larvae) one transverse row. Anal pore triradial. Body white. Head light rust, mandibles black, anterior margin of epistoma dark brown. Pronotum laterally and on anterior margin light rust. Length of mature larvae 16 to 18 mm. Stadial variability manifest in body, I-instar larvae covered with very long hairs, and abdominal tergite IX without spinule; latter seen after molt in II-instar larvae.

Pupa (Figure 62): Well distinguished from pupae of the genus *Brachyta* in structure of abdominal tergites and presence of lateral hairs on sternites. Quite similar to pupae of the genus *Gaurotres*. Body bent. Head markedly bent under. Frons elongate, slightly transversely convex between antennae and here with stray minute setae; median groove in form of narrow streak. Antennae flexed to sides, in second half, behind mid-femora, arc ventrad.

Pronotum broadens posteriorly, narrows anteriorly, with broad flange produced angularly on sides, markedly bent along anterior margin, with dense long thin setae; posterior margin with thick long setae on digitate bases forming dense narrow transverse row interrupted medially; on disk uniformly convex, with thin transverse dashlike striation and short stray setae. Meso- and metanota with two small tufts each of paramedial setae on disk.

Abdomen narrows markedly from anterior to posterior end. Abdominal tergites convex, with long piliform setae in posterior half forming transverse band, and paramedial tufts (in pupae of the genus *Brachyta* these setae are thick and disposed on paired pillowlike tubercular prominences). Last abdominal tergite terminates in long, sharp, brownish, sclerotized spinule. Abdominal sternites laterally with long stray, sometimes very dense, setaceous hairs. Tip of abdomen ventrally bound by



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Figure 62. Pupa of *Evodinus borealis* (Gyllh.), female.

pillowlike carina set with sparse setaceous hairs. Valvifers of female large, insignificantly separated, apically papilliform along sides. Length of body 7.0 to 9.0 mm, width of abdomen 3.0 to 3.5 mm.

Material: Collected in eastern Ural region, in Altai, Baikal region, Ob' region, Trans-Baikal, Tuva, and Ussuri-Primor'e region. Adult insects 328, larvae 88, pupae 19.

Distribution: From Atlantic to Pacific Ocean coasts. Found in large numbers in Altai, sighted sporadically in eastern Ural region, the Sayans, in Yenisey forests, Baikal region, Trans-Baikal, and Ussuri-Primor'e region.

Biology: Inhabits coniferous forests, rarely seen in large numbers,

mainly found in mountain forest belt. Flight of beetles commences in May and ceases in August. Beetles maximum in foothill regions in June, in mountains at a height of 2,000 m above sea level, in first 10 days of July. Thus, in Altai during long-term collections around Lake Telets at a height of 400 to 500 m, of every 100 beetles two were found toward end of May, 11—first 10 days of June, 43—middle 10 days, 23—last 10 days, and 21—in July. In Kolyushtu mountains at a height of 2,000 m three beetles were caught in the last 10 days of June, 81—first 10 days, and 16—throughout July. Hence in high-altitude regions the flight of beetles is very short, extending into the second half of summer.

Emerging beetles appear on flowers of spiraea, Umbelliferae, and other plants. They feed on pollen and petals of flowers. Later, when the gonads mature, they mate. Female lays eggs in bark crevices of drying and freshly fallen trees of fir, maple, and other coniferous species. Mainly branches and trunks of undergrowth up to 8.0 cm in diameter are colonized. Beetles live for 25 days, some as long as five weeks. One female caught on flowers on July 26 lived in the laboratory up to August 28. During this period she laid several eggs. Ovaries of another female caught on flowers contained 42 eggs.

In nature, at a temperature of 16.9°C ($\pm 0.5^{\circ}\text{C}$), development of eggs from time of oviposition to hatching of larvae continues for 12 to 21 days, average 16 ± 0.2 days. Under climatic conditions of foothill regions the maximum larvae hatch in middle 10 days of July. For example, larvae hatched from 176 eggs under observation in the forest as follows: 55 (31.25%)—July 6th through 10; 77 (43.75%)—July 11 through 15; 38 (21.6%)—July 16 through 20; and six (3.4%)—July 21 through 25. First larvae sighted in first 10 days of July and last in August.

After hatching larvae bore into bark, make galleries under it along shoots, leaving shallow impression on wood surface. Galleries sealed with fine bark frass, at places admixed with wood. Width of gallery initially 2.0 mm, increasing to 8.0 mm terminally; length up to 10 to 15 cm. Mature larva makes exit in bark, cuts an oval opening (4.0 mm \times 1.5 mm) on surface, and falls onto soil through it; there it makes a cell and pupates. Length of pupal cell 10 mm, width 8.0 mm. Emergence of larvae for pupation commences after first hibernation in last 10 days of July and ceases in second half of August. Some larvae remain in their galleries under bark for second winter and pupate in the following spring. In 1975 near Artybash (Altai) larvae began to pupate on July 27. In gardens with a forest environment 22 larvae were recovered, of which two (9.1%) were found on July 31, 16 (72.8%) from August 1st to 10, and four (18.1%) from August 11 to 20. During the period of larval appearance the atmospheric temperature varied from 5.2°C

in the morning to 27.4°C later in the day. Pupation of larvae in soil commenced August 22 and ended August 28. Some larvae pupated 10 days after emergence and others four weeks later. Pupation of larvae in soil occurs at 10 to 12°C. On digging, the first pupa was found in soil under a dead maple on August 27. Pupal development is inhibited since pupae enter diapause and overwinter. During this period they withstand low temperatures up to -1.2°C or more. In 1976, under laboratory conditions, larvae emerging on the soil for pupation on May 3rd were immediately placed in a refrigerator at 11°C; they pupated on June 4th. A beetle (weight 27.8 mg) developed from a pupa on September 13. The pupal stage continued for 101 days. During this period the refrigeration temperature ranged from 11 to 16°C. Emergence of beetles in nature occurs in April and early May. Their emergence from soil commences in May and ends in June.

Weight of larvae at time of entering the soil varies from 16 to 67 mg and of pupae before hibernation 13.7 to 49.0 mg. Some insects of much larger dimensions are also seen; some larvae before descending from shoots weigh up to 154 mg. In 1976 we weighed 24 larvae just entering the soil. Their weight ranged from 31 to 67 mg, average 49.4 ± 2.3 mg. Weight reduction during the prepupal period is small and much more during the pupal period. This is evidently characteristic of this species. For example, nine insects kept under observation in the laboratory weighed a total of 353.1 mg (100%) in the larval stage and 362.4 mg (94.5%) in the pupal; three insects weighed 153.5 mg (100%) in the larval stage and 113.5 mg (73.9%) in the adult, i.e., after development the weight of insects in these two instances dropped by 5.5% and 26.1% throughout the period of metamorphosis. Life cycle completed in two years, rarely three.

Evodinus borealis (Gyllh.) colonizes only physiologically weakened and freshly fallen trees, developing on primary and secondary shoots and on trunks of undergrowths 2.0 to 8.0 cm in diameter. In cuttings taken from nature larvae were detected as follows: 44 on fir, 52 maple, five spruce, and three pine. In Altai larvae prefer fir and maple, rarely other plants. They are found in large numbers on freshly cut residue. Dry shoots with desiccated roots do not attract them. *Acmaeops smaragdula* (F.), *A. angusticollis* (Geb.), *Gaurotes virginea* (L.), *Clytus arietoides* Reitt., and other species of woodborers were found together with this species, sometimes on the same shoots.

8. Genus *Sachalinobia* Jacobs.

Jacobson, 1899, *Ann. Mus. Zool. St. Petersb.*, vol. 4, p. 39; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 204-205; Gressitt, 1951, *Longicorn Beetles of China*, vol. 2, p. 55; Linsley and Chemsak, 1972, *Ceramby-*

cidae of North America, vol. 69, p. 90.

Adult: Characterized by insignificant narrowing of head behind eyes, laterally produced tubercle on pronotum, and coarse rugose sculpture on elytra.

Larva: Distinguished by sclerotization of locomotory ampullae and eusternum, developed thoracic legs, and pointed sclerotized spine on tip of abdomen.

Pupa: In general characteristics and arrangement of setae on dorsal side proximate to pupae of the genus *Brachyta*. Distinguished by reduced prominences on abdominal tergites.

Two species belong to this genus; one occurs in the eastern part of the Asian mainland, the other (*Sachalinobia rugipennis* New.) in North America.

Type species: *Brachyta koltzei* Heyden, 1887 (= *S. retata* Jacobson).

135 1. *Sachalinobia koltzei* (Heyd.)

Heyden, 1887, *Deutsch. Entom. Z.*, vol. 31, p. 340 (*Brachyta*); Jacobson, 1899, *Ann. Mus. Zool. St. Petersburg.*, vol. 4, p. 40; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 205-206.

Adult (Figure 63): Readily distinguished by coarse rugose sculpture on elytra. Head elongate, with fine deep fused punctation, with adherent, comparatively dense hairs, deep narrow suture between antennae, some narrowing behind eyes, and temples almost flat. Antennae in male extend more or less beyond 0.66 length of elytra, in female 0.50 their length, with fine dense punctation; 3rd antennal segment longer than 4th, equal to 5th.

Pronotum longer than wide, narrows somewhat more anteriorly than posteriorly, with broad flange on anterior margin, shallow groove at base, bulges laterally and with faint tubercles here, with smooth longitudinal line interrupted medially; with sinuous uneven coarse wrinkles and sparse minute adherent hairs that do not form continuous cover. Scutellum broad and triangular, with dense punctation.

Elytra convex, narrow slightly from humeri to apex; with transverse, coarse, deep, fused punctation that forms coarsely rugose sculpture; apex generally rounded, rarely obtuse. Hind femora distinctly short, do not reach elytral apex; tarsi short, considerably shorter than tibiae. Body blackish-brown, almost black. Elytra bronze, with transverse rusty or yellowish band behind middle. Legs dark red with brownish tone. Antennae black, often rusty with rather reddish tinge. Length of male up to 14 mm, of female up to 18 mm.

Egg: White, elongate, rounded at poles; with fine deep punctures resembling alveoli and forming thin tegular sculpture. Length 1.8 mm, width 0.5 mm.

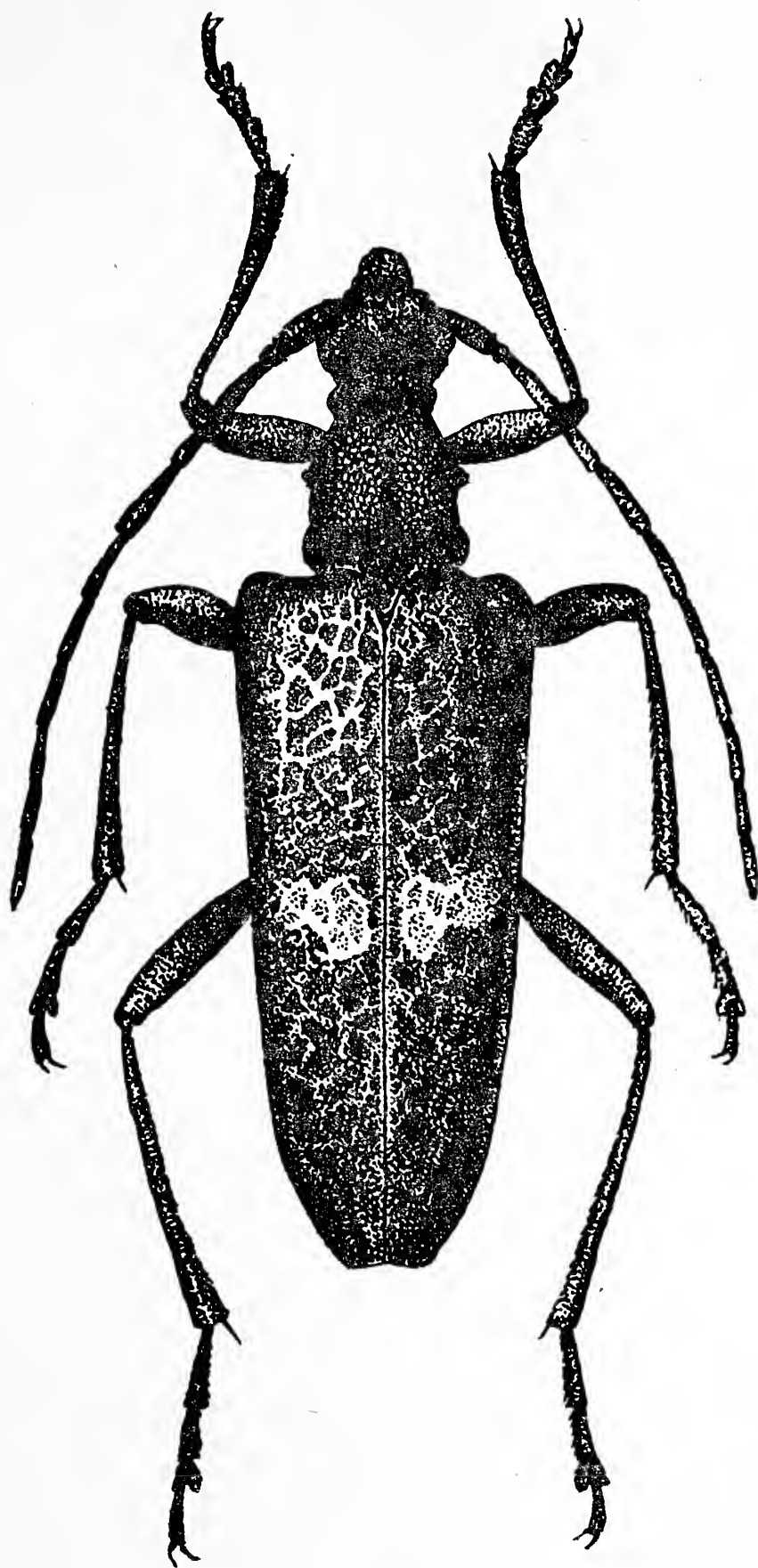


Figure 63. *Sachalinobia koltzei* (Heyd.).

- 136 *Larva* (Figure 64): Body elongate. Head flat, narrowly rounded anteriorly, slightly retracted into prothorax. Epistoma (frontal plate) triangular, bound laterally by indistinct white frontal sutures. Longitudinal suture distinctly seen almost up to anterior margin. Frontal plate

and parietals in anterior half with innumerable acicular setae of two types (long and short). Hypostoma somewhat narrowly rounded anteriorly, medially divided by white band; with long acicular setae and 11 or 12 setae on each side of white band. Lateral sutures of hypostoma distinctly visible only in anterior half, not posteriorly. Clypeus transverse, convex, lustrous, dark red basally, white anteriorly. Labrum elongate, narrowly rounded anteriorly, convex, smooth, almost glabrous, with pair of long setae on disk forming transverse row, and short setae

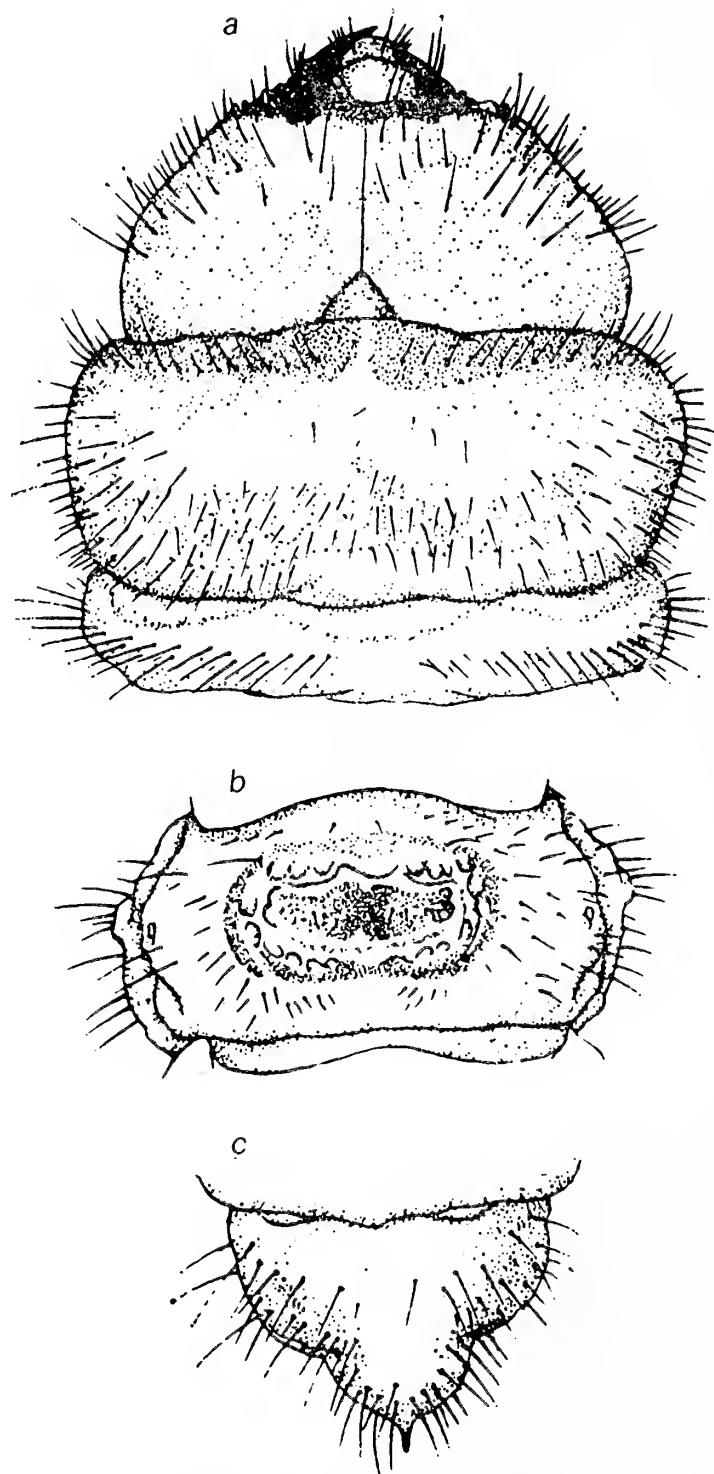


Figure 64. Larva of *Sachalinobia koltzei* (Heyd.).
a—head and pronotum; b—abdominal tergite with
locomotory ampulla; c—tip of abdomen.

on margins. Mandibles long, sharply truncate apically, rostriform (lateral view); outer side with transverse projection at or behind middle.

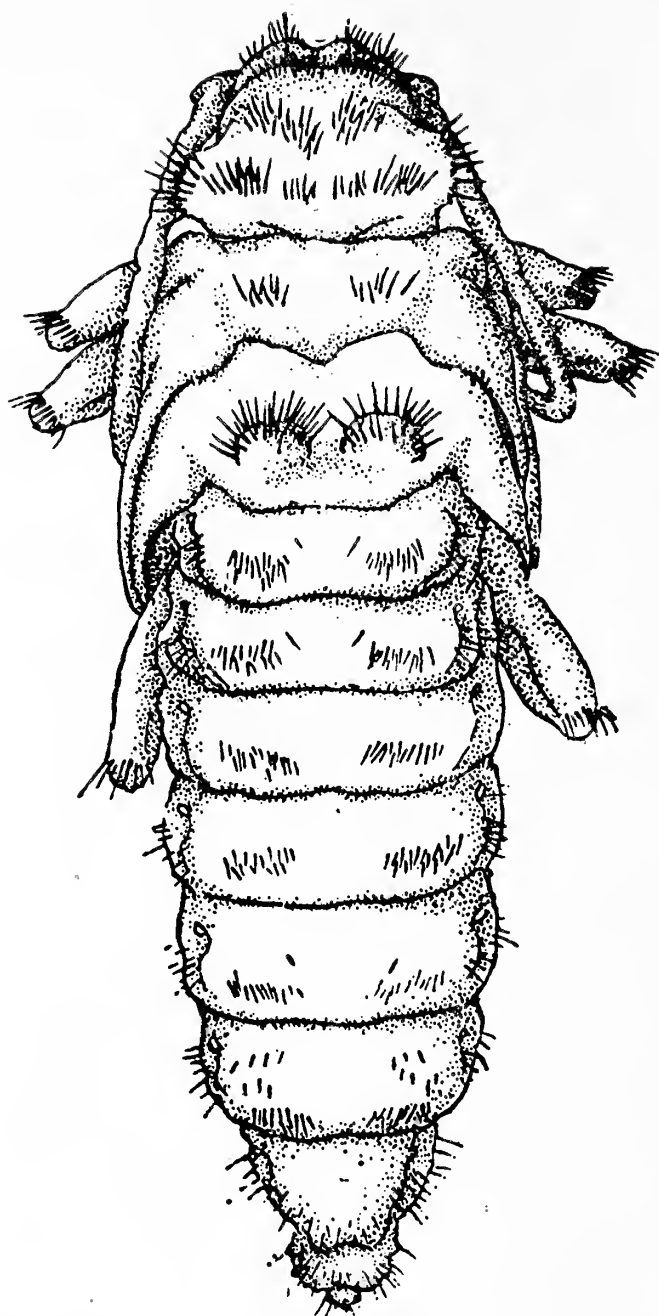
137 Pronotum barely broader than head, transverse, laterally rounded, flat on disk, in anterior third with sparse setaceous hairs forming transverse narrow band, and laterally, closer to base, with long hairs. Pronotal shield slightly convex, without lateral longitudinal folds, with minute, deep, sometimes smoothened wrinkles, and numerous short acicular setae. Prosternum with sparse diffuse setae; eusternum sclerotized, only laterally and at base coriaceous, without sclerotization; with up to four long and 12 to 16 short setae. Legs well developed, with long slightly bent and sclerotized claws.

Abdomen elongate. Abdominal tergites laterally with numerous short setaceous hairs. Dorsal locomotory ampullae convex, located on first six tergites, sclerotized, with dense minute spinules; divided by common longitudinal groove, with two indistinct transverse grooves, deep longitudinal lateral folds; between transverse grooves with two or three paramedial setae on each tergite forming transverse row. Tergites VII to VIII smooth, without ampullae, with short hairs. Ventral locomotory ampullae almost similar in structure and sclerotized. Abdominal tergite IX small, with long setaceous sparse hairs and sharp conical sclerotized apical spine. Body white, head light rust, almost black on anterior margin. Labrum and base of clypeus dark red. Mandibles black. Pronotum in anterior third with yellowish-rust transverse band that fuses with yellowish-rust color laterally. Length of body up to 30 mm, width of head 5.0 mm, and width of prothorax 6.0 mm.

Pupa (Figure 65): Body coriaceous. Head elongate, markedly bent under; sparse, thin piliform setae on inner side of frons, near antennae, and on vertex. Antennae short, arcuate, turn around midfemora, with apices flexed to elytra.

Pronotum narrows insignificantly anteriorly, produced laterally, closer to base, into tubercle; setae on anterior and posterior margins form comparatively dense transverse row, disk medially with dispersed setae forming broad transverse band. Mesonotum with tender setae forming two tufts. Metanotum with very long flexible setae forming two tufts on more or less distinct tubercular prominences.

Abdomen thick, its tip sometimes slightly bent under. Abdominal tergites transversely convex behind middle and here with long thin setae forming transversely elongate paramedial tuft on each tergite. Anterior to these tufts, on inner side, long lateral setae directed medially occur. Abdominal tergite IX with short sclerotized apical spinule, sometimes without it. Valvifers of female hemispherical, contiguous, and laterally papilliform at apex. Length of body 14 to 20 mm, width of abdomen 5.0 to 5.8 mm.



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Figure 65. Pupa of *Sachalinobia koltzei* (Heyd.).

Material: Collected in Ussuri-Primor'e region and in Sakhalin. Adult insects 27, larvae 67, pupae three, larval exuviae from pupal cells with beetles five.

Distribution: In forests of Amur basin up to the Pacific Ocean coast, Ussuri-Primor'e region, Sakhalin; northeast China, Korea, and Japan.

Biology: Inhabits coniferous woodstock and ecologically associated with fir. Flight of beetles commences from May and extends up to July inclusive. Highly numerous in first half of June. Female lays eggs in basal zone of trunks (not more than 40 cm) and on underground roots of dead trees and stumps of wind-fallen ones. One female can lay up to 160 eggs. I have collected five to fifteen eggs from one site. Once, in a cleavage in the wood of a wind-fallen stump, 41 eggs were found, all
138 laid one after the other. Eggs laid in wood crevices, under intact bark,

and in bark fissures. Mainly thick-trunked Khingan and Manchurian fir (*Abies nephrolepis* and *Abies holophylla*) colonized. Development of eggs under natural conditions at an average temperature of 16.7°C takes 20 to 25 days. Hatching of larvae observed in last 10 days of June and in July. Maximum number sighted end of June and in early July.

Larvae live mainly in thick roots, in upper stable layer of wood not damaged by fungi; they migrate from basal zone of trunk to roots and make there longitudinal galleries from base to apex, and plug them with fine frass. Larvae sometimes molt frequently during their life span. One larva molted three times. Its weight before molt was 162 mg, after first molt 153.4 mg, second molt 146.4 mg, and 10 days after third molt 155.2 mg. Such cyclic molting, accompanied by significant weight reduction, occurs evidently under unfavorable environmental conditions. Larvae of the last instar make a spacious chamber in upper wood layer, line its sides with large fibrous bits, and make a pupal cell 10 mm × 14 mm to 20 mm × 26 mm. Length of larval galleries in roots 80 to 90 cm, width before pupal cell 10 to 18 mm.

Pupation of larvae occurs end of summer. Developing beetles overwinter. Hibernation of beetles occurs in wood and soil. On emerging beetles bite into root surface, form an oval opening (5.0 mm × 7.0 mm to 5.0 mm × 9.0 mm) and abandon pupal cell through it. It is possible that part of the larval population pupates in early spring. Weight of larvae before pupation 186.5 to 421.0 mg, pupae 168.3 to 401.8 mg, and beetles 83.5 to 203.1 mg. Total duration of life cycle three years. *Megasemum quadricostulatum* Kr. was found in large numbers together with this pest on the same trees.

9. Genus *Gaurotes* LeConte

LeConte, 1850, *J. Acad. Philad.*, 1, 2, 324; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 207; Plavil'shchikov, 1958, *Entomol. Obozr.*, 37, 3, 120-123.

Adult: Characterized by distinct flange in anterior third of pronotum, small and indistinct or large obtuse lateral tubercle on pronotum, elytra broaden at humeri and with coarse punctation, and either metallic bronze, green, or lustrous blue.

Larva: Distinguished by flat head, epistoma divided anterior to middle of transverse white band, prosternum with isolated piliform setae, eusternum laterally in anterior half with three setae, and dorsal locomotory ampullae with small hyaline granules forming four transverse rows. Abdominal tergite IX flat, laterally bound by carina, with four long thick setae on disk forming transverse row, and more or less developed apical spinule.

Pupa: Body somewhat concave and bent under. Pronotum markedly narrows anteriorly, with sharp flange anteriorly, and on anterior and posterior margins with long setae on papilliform tubercles forming dense transverse row. Metanotum with two setaceous tubercular prominences. Abdominal tergites with long setae on posterior margin. Tip of abdomen usually with more or less developed, projecting, and slightly sclerotized spinule.

Species of the genus *Gaurotetes* are ecologically associated with woody plants. Larvae develop under bark but enter soil for pupation. Seven species of this genus are known in Siberian fauna; of these, one species is distributed from the Atlantic to the Pacific Ocean coast, another in Trans-Baikal, four in forests (mainly in Ussuri-Primor'e), and one on islands of the Far East.

Type species: *Leptura cyaneipennis* Say, 1823.

KEY TO SPECIES

Adult Insects

- 1 (10). Elytra together rounded apically.
- 2 (5). Prothorax laterally with small indistinct tubercle; pronotal disk without erect hairs. Body small, comparatively short, 6.0 to 12.0 mm (subgenus *Gaurotetes* s. str.).
- 3 (4). Abdomen red (ssp. *thalassina* Schr.), only sometimes black, with indistinct faint punctation. 1. **G. virginea** (L.).
- 4 (3). Abdomen black, only sternites II to III sometimes partly red, with distinct transversely elongate punctation. 2. **G. kozhevnikovi** Plav.
- 5 (2). Prothorax laterally with large obtuse conical tubercle shifted slightly backward; pronotal disk with erect hairs.
- 6 (9). Pronotal disk with short erect hairs (subgenus *Pseudogaurotina* Plav.).
- 7 (8). Head, prothorax, and scutellum black; abdomen, disk of metathorax and legs light rust. Length 16 mm. 3. **G. splendens** B. Jak.
- 8 (7). Entire body (including abdomen and metathorax) black, legs dark brown with reddish-rust tone. Length 17.5 to 18.0 mm. 4. **G. magnifica** Plav.
- 9 (6). Pronotal disk with dense long erect hairs (subgenus *Gaurotina* Ganglb.). Abdomen, metathorax, and legs light yellow. Length 14 mm. 5. **G. superba** (Ganglb.).
- 10 (1). Elytra notched at apex, with produced outer angles (subgenus *Paragaurotes* Plav.).

- 11 (12). Elytra dark greenish-bronze, with inner margin basally elevated so that scutellum appears markedly depressed. Femora basally dark red. Length 9.0 to 14.0 mm. 6. **G. ussuriensis** Bless.
- 12 (11). Elytra bright light green, without bronze tinge; inner margin negligibly elevated basally, scutellum not notably depressed. Femora basally light yellow with rusty tinge. Length 11 to 15 mm. 7. **G. suvorovi** Sem.

Larvae

- 1 (4). Lateral sutures of hypostoma long, 0.50 their width at anterior margin; space between posterior end of sutures and oblique transverse groove at base small (subgenus *Gaurotos* s. str.).
- 2 (3). Abdominal tergite IX with well-developed sharp brownish apical spinule. Sternite IX in posterior half usually with six setae forming distinct transverse row. 1. **G. virginea** (L.).
- 3 (2). Abdominal tergite IX with indistinct, light-colored, usually obtuse apical spinule. Sternite IX in posterior half usually with eight (rarely six) setae forming transverse, sometimes indistinct row. 2. **G. kozhevnikovi** Plav.
- 140 4 (1). Lateral sutures of hypostoma short, not more than 0.33 their width at anterior margin (subgenus *Paragaurotos* Plav.).
- 5 (6). Hypostoma with parallel sides, broad; lateral sutures 0.25 their width. 6. **G. ussuriensis** Bless.
- 6 (5). Hypostoma narrows slightly in front, not very broad; lateral sutures 0.33 their width at anterior margin. 7. **G. suvorovi** Sem.

Pupae

- 1 (4). Pronotum basally with nine to thirteen, on anterior margin with six to ten setae forming transverse row at each site. Setae on abdominal tergites distinctly shorter than tergites per se. Apex of hind femora with 10 to 11 setae. Length of body up to 10 mm.
- 2 (3). Setae on apex of hind femora do not form distinct transverse row, but rather diffuse tufts. 1. **G. virginea** (L.).
- 3 (2). Setae on apex of hind femora, especially on inner side, form distinct transverse row. 2. **G. kozhevnikovi** Plav.
- 4 (1). Pronotum basally with 15 to 16, on anterior margin with 10 to 16 paramedial setae forming transverse row at each site. Setae on abdominal tergites not shorter, or only slightly shorter than

tergites per se. Apex of hind femora with 17 to 18 setae. Length of body usually more than 10 mm.

- 5 (6). Setae at apex of hind femora form two distinct transverse rows. Mesonotum glabrous, without setae. . . 6. **G. ussuriensis** Bless.
 6 (5). Setae at apex of hind femora do not form distinct transverse rows, but tufts. Mesonotum with stray setae. 7. **G. suvorovi** Sem.

1. **Gaurotes virginea** (L.)

Linnaeus, 1758, *Syst. Nat.*, 10th ed., p. 393 (*Leptura*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 209-210; Starzyk, 1968, *Z. für Angewan., Entomol.*, 83, 3, 269-281 (*Carilia*).

Adult (Figure 66): Readily distinguished from other species by color of abdomen. Body slightly elongate. Head in front of antennae with smoothened sparse punctation, posterior to antennae with dense umbilicate punctation. Spaces between punctation here smaller than punctures per se. Antennae barely reach beyond middle of elytra (female) or apices reach posterior third (male).

Pronotum convex, with indistinct tubercle laterally, anteriorly distinct flange that is less distinct along anterior margin, basally with transversely sloping groove; with coarse deep punctation, medially sometimes with smooth band; length of pronotum almost not more, or slightly more than width at base. Scutellum broad, triangular, with dense punctation. Legs short; femora not convex, without spinule on lower side of rounded apices. Elytra bulge, broad, parallel; apically generally rounded, with broadly curved border laterally behind humeri, and with dense larger punctation forming distinct striation.

- 141 Abdominal tergites smooth, with very sparse indistinct punctation, sparse hairs not forming continuous cover, which are more distinct in male than in female. Sternite V at posterior margin with sparse hairs not forming fringe (female) or with dense setaceous hairs forming fringe (male). Head, underside of thorax, scutellum, and legs black. Antennae dark brown. Elytra blue or violet. Pronotum and abdomen red (*G. virginea thalassina* Schr.). Body length of male and female 7.5 to 12.5 mm.

Egg: Silvery-white, elongate, narrows gently toward one pole, steeply toward the other, narrowly rounded at both. Chorion with dense deep cells; spaces between them slightly smaller than cells per se. Length 1.0 mm, width 0.4 mm, weight 0.16 mg.

Larva (Figure 67): Body flat, narrows posteriorly. Head flat, transverse, uniformly rounded laterally, somewhat retracted into prothorax. Epistoma triangular, bound laterally by well-developed frontal suture, divided in middle by brownish longitudinal suture, in anterior half with transverse white band that curves in middle. Hypostoma flat, with

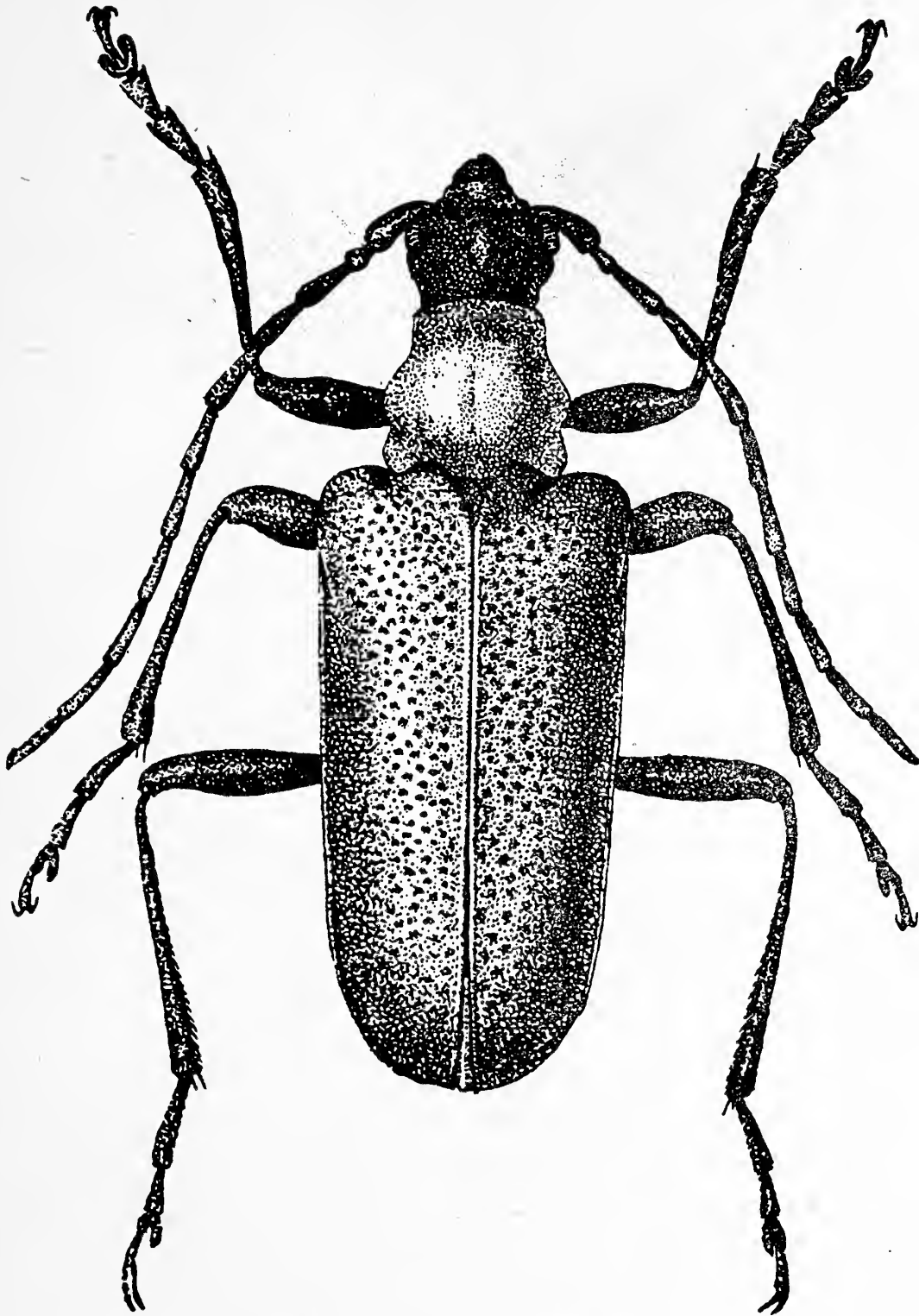


Figure 66. *Gaurotes virginea* (L.).

142 narrow median longitudinal white stripe, basally with deep oblique tentorial alveoli that extend from posterior angles to middle. Lateral sutures of hypostoma long, length 0.50 their width at anterior margin. Parietals laterally in anterior half and middle (ventral view) with identical setaceous hairs forming transverse row. Clypeus broad and transverse. Labrum broadly rounded on anterior margin, with dense setae. Mandibles elongate, apically obliquely truncate.

Pronotum transverse, roundly produced laterally, with sparse setae; glabrous and flat on disk. Pronotal shield indistinctly striate, not bound laterally, without longitudinal folds. Prosternum with stray setae form-

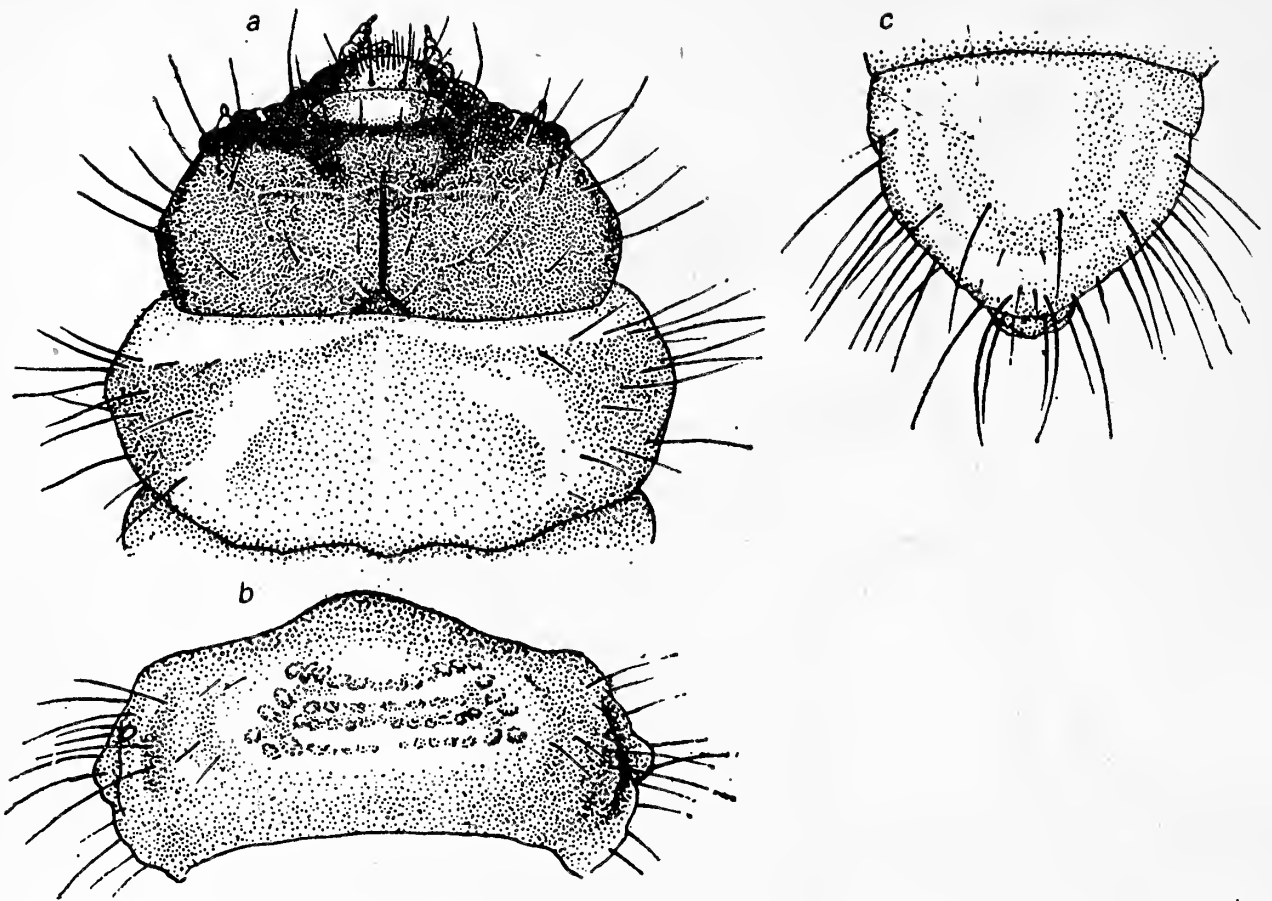


Figure 67. Larva of *Gaurotes virginea* (L.).
a—head and pronotum; b—abdominal tergite
with locomotory ampulla; c—tip of abdomen.

ing transverse row in anterior half. Thoracic legs long, with brownish bent claws.

Abdomen elongate. Abdominal tergites transverse, angularly produced laterally, with long thick setae. Dorsal locomotory ampullae with minute granules forming four transverse rows. Middle rows highly proximate, form common carina. Ventral locomotory ampullae with two rows of not very large granules. Abdominal tergite IX laterally bound by carina, with four thick setae on disk forming transverse row, and reddish-brown apical spinule. Posterior half of sternite IX with six large uneven setae, rarely eight, forming transverse row; glabrous and lustrous on disk; laterally, anterior to middle, with short seta. Body white. Anterior half and sides of pronotum rusty. Head reddish-rust. Mandibles black. Length of III-instar larvae 16 to 18 mm, width of head 2.5 to 3.0 mm.

Pupa (Figure 68): Body slightly elongate. Head elongate, in region of frons with paired widely separated setae, behind eyes with tuft of setae. Antennae short, flexed to sides, with apices bent ventrad.

Pronotum in anterior half with broad flange, laterally, closer to base, tubercularly produced, on anterior margin with six or seven thin,

on posterior margin 11 to 13 long thick paramedial setae forming transverse row interrupted medially (each seta set on minute papilla); and thin piliform setae laterally. Mesonotum glabrous, without setae. Metanotum with two setaceous protuberances.

143 Abdomen elongate. Abdominal tergites with paramedial piliform setae forming transverse band. Apical tergite of abdomen bound by setaceous carina and produced into nonsclerotized spinule at tip. Apex of hind femora with long setae forming tufts. Valvifers of female large, hemispherical, with papilliform protuberance at apex. Length up to 10 mm.

Material: Collected in eastern Ural region, Ob' region, Altai, Baikal region, Tuva, Trans-Baikal, and Ussuri-Primor'e region. Adult insects 574, including 72 raised in the laboratory, larvae 138, pupae 19.

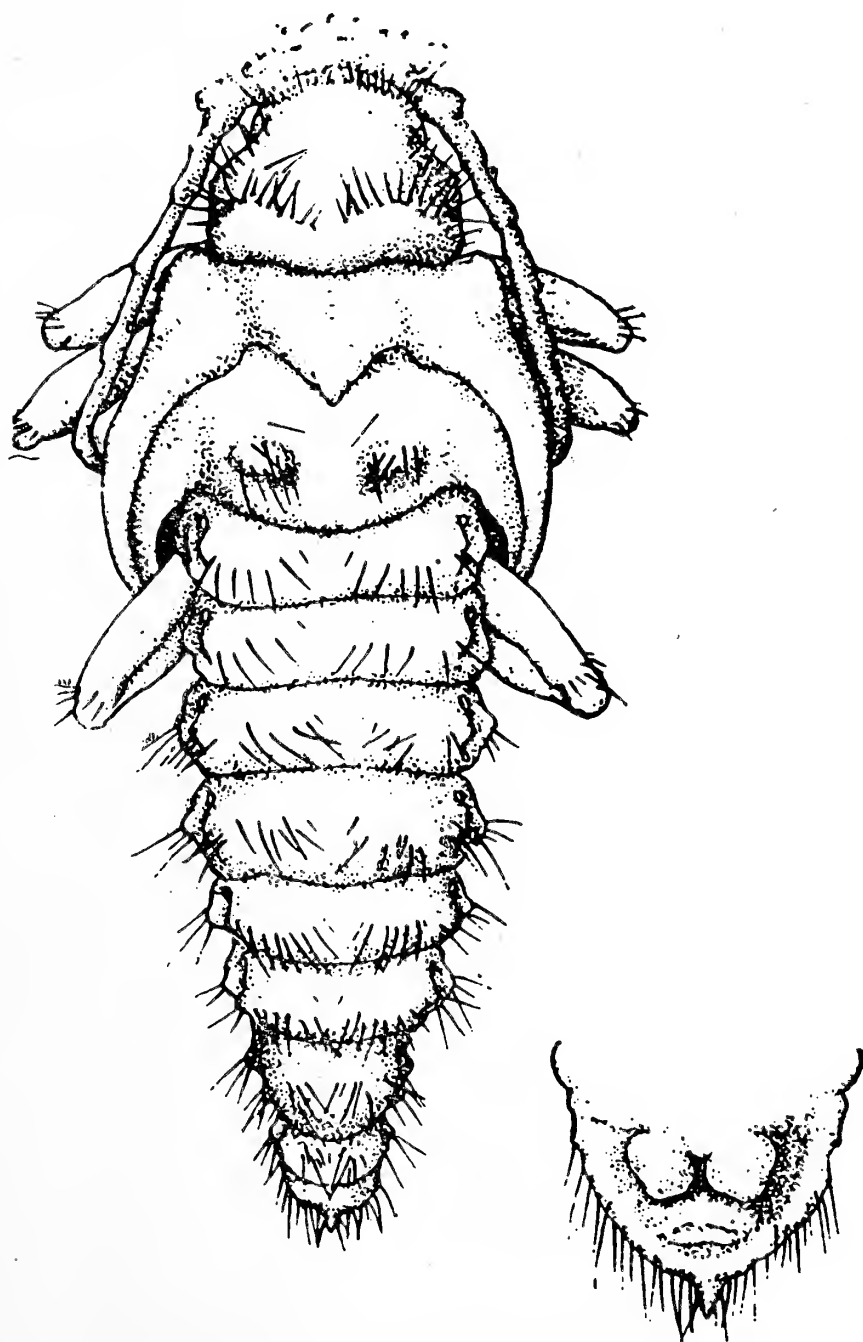


Figure 68. Pupa of *Gaurotes virginea* (L.), female.

Distribution: From Atlantic to Pacific Ocean coasts, Sakhalin; northern China, Mongolia. One subspecies (*G. virginea thalassina* Schr.) distributed in coniferous forest zone in Siberia.

Biology: Inhabits coniferous forests. Flight from June through July. Beetles maximum in July. During systematic collections in Tuva five beetles were caught in last 10 days of June, 165—first 20 days of July, and 12—last 10 days of July. In Lake Telets region of Altai, of every 100 beetles collected 20 were found in June, 73—July, and seven—August. Beetles emerge with underdeveloped gonads and require supplementary feeding; they feed on flowers and live for four to five weeks. Female lays eggs in bark crevices, sometimes in recesses of dead conifers. One female can lay up to 54 eggs in her lifetime. Trunks and branches of decaying (standing) and felled trees colonized: maple, spruce, larch, fir, and pine. Larvae hatch from eggs 10 to 20 days, average 13.9 days, after oviposition. In 1970 in the forest of eastern Tannu-Ol' mountain range, larvae began hatching on July 6th from eggs laid on June 20.

After hatching larvae bore under bark, make meandering, longitudinal, sometimes spacious galleries and plug them with frass. In autumn, before second hibernation, they cut oval openings (2.0 mm × 2.5 mm) on bark surface and falling through them burrow into soil to a depth up to 5.0 cm. There they make pupal cells and enter diapause. Length of pupal cell up to 8.0 mm, width 6.0 mm.

144 Larvae pupate in spring, in May and June, at a soil temperature of 8.0°C. Pupae maximum in middle 10 days of June. Pupae develop at soil temperature of 12 to 14°C. Beetles emerge from pupae three to four weeks later and remain in pupal cells for not more than seven days. Life cycle completed in two years. Weight of larvae during period of entering soil varies from 15 to 55 mg, prepupae 17 to 66 mg, pupae 16.2 to 64.0 mg, and adult insects before emerging from cells 15.7 to 55.0 mg. Before pupation weight of larvae in soil quite often increases due to absorption of soil moisture. For example, of 55 larvae an increase in weight was recorded for 11 in the prepupal period. The total weight of other larvae just entering the soil was 374.7 mg (100%), of pupae developing from them 406.5 mg (108.4%), i.e., 8.4% more than the initial weight. Weighings of a large series of beetles during metamorphosis revealed a general trend in weight reduction (Table 5). However, soil moisture exerts a marked influence on the weight index. The lower the soil moisture, the higher the weight reduction of beetles during metamorphosis. Most favorable conditions are found at 20 to 24% soil moisture (dry weight basis) and relative atmospheric humidity of soil not less than 100%.

This species is often found together with *Acmaeops angusticollis*

Table 5. Weight variation in *Gaurotes virginea* (L.) during metamorphosis

Stage	Male			Female		
	No. of insects	Mean weight, mg	Weight, %	No. of insects	Mean weight, mg	Weight, %
Prepupa	22	36.4±1.5	100.0	33	41.7±1.9	100.0
Pupa	22	35.2±1.4	96.7	33	40.8±1.9	97.8
Young adult	22	30.2±1.1	83.0	33	34.9±1.6	83.6

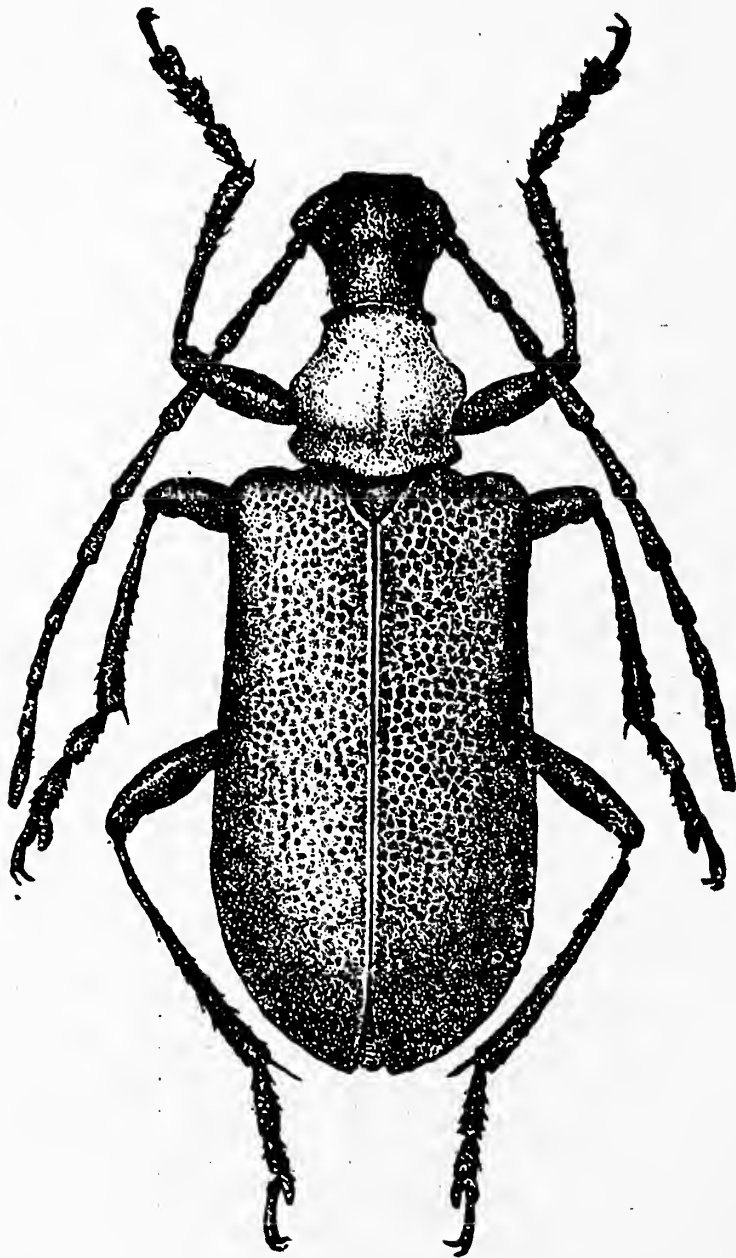
(Gebbl.), *A. septentrionis* (Thoms.), and other species.

2. ***Gaurotes kozhevnikovi* Plav.**

Plavilstshikov [Plavil'shchikov], 1915, *Entomol. vestrik.*, vol. 2, p. 125; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 211-212.

Adult (Figure 69): Proximate to *G. virginea thalassina* Schr. Differs in black color of abdomen and other features. Head behind antennal base with coarse dense punctation (spaces between punctures smaller than dots per se), with faint red spot on vertex.

Pronotum somewhat longer than width at base, convex on disk, with faint median longitudinal groove, deep coarse punctation, distinct small tubercle laterally, narrows anteriorly, with broad flange. Elytra convex, broadly rounded posteriorly, with coarse rugose punctation.



Abdominal sternites with sparse sharp punctation (especially in female); punctures transversely elongate, with short erect hairs laterally (female) or comparatively dense hairs (male) forming coarse texture. In male of *G. virginea thalassina* Schr. hairs on abdominal sternites do not form dense cover; abdomen therefore does not appear pubescent ventrally. Head, underside of body, and legs black; pronotum red. Sometimes only abdominal sternites II to III with reddish border on anterior margin (male). Antennae blackish-brown or black. Length of body 7.5 to 11.0 mm.

Egg: White, elongate, narrowly rounded at poles. Chorion with dense cellular sculpture. Length 0.9 mm, width about 0.4 mm.

Larva (Figure 70): Differs from *G. virginea thalassina* Schr. in indistinct, weakly sclerotized apical spinule on tergite IX, and usually large number of setae on abdominal sternite IX. Body flat, narrows behind prothorax. Head markedly flattened, broad, notably narrows in front. Epistoma along sides of longitudinal suture in zone of transverse white band with longitudinal setaceous dents. Hypostoma flat, with setaceous pore on anterior margin along sides of white band.

Pronotum flat, short, its length 0.33 width, laterally with identical thick long setae forming three transverse rows; on disk, anterior to middle, with pair of short widely separated setae. Abdominal tergites slightly convex, with long paired setae laterally behind spiracles forming transverse row. Dorsal locomotory ampullae with four rows of fine granules. Abdominal sternites flat. Ventral locomotory ampullae with two rows of granules. Sternite IX in posterior half usually with eight setae (rarely six) forming transverse row. Tip of abdominal tergite IX with faint light-colored obtuse spinules (in *G. virginea thalassina* Schr.

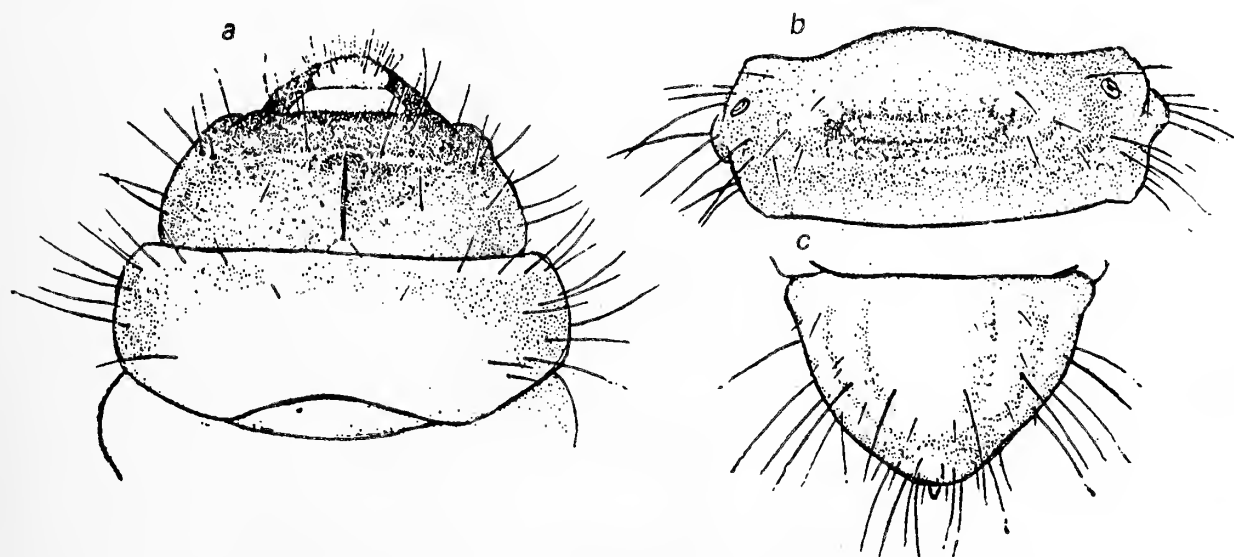


Figure 70. Larva of *Gaurotes kozhevnikovi* Plav.

a—head and pronotum; b—abdominal tergite with locomotory ampulla; c—tip of abdomen.

this spinule is long, acute, and brownish). Body white. Head reddish-rust. Mandibles black. Pronotum in anterior half and on sides yellowish-rust, medially with white longitudinal band. Body length of mature larvae 10 to 15 mm, width of head up to 3.0 mm.

- 146 *Pupa* (Figure 71): Differs from pupa of *G. virginea thalassina* Schr. in short spinule at tip of abdomen. Body narrows posteriorly and slightly concave. Head elongate, markedly bent under in front. Frons between antennae smooth, flat or transversely convex, with stray setae along margins. Behind eyes long setae disposed singly (female) or in tufts (male). Antennae flexed to sides, curve ventrad behind mid-femora.

Pronotum narrows toward front, with sparse setae, laterally produced into faint tubercle; nine to ten setae on anterior margin and ten long setae on posterior margin form dense transverse paramedial row; stray setae on disk anterior to middle. Mesonotum glabrous, metanotum with two setaceous prominences.

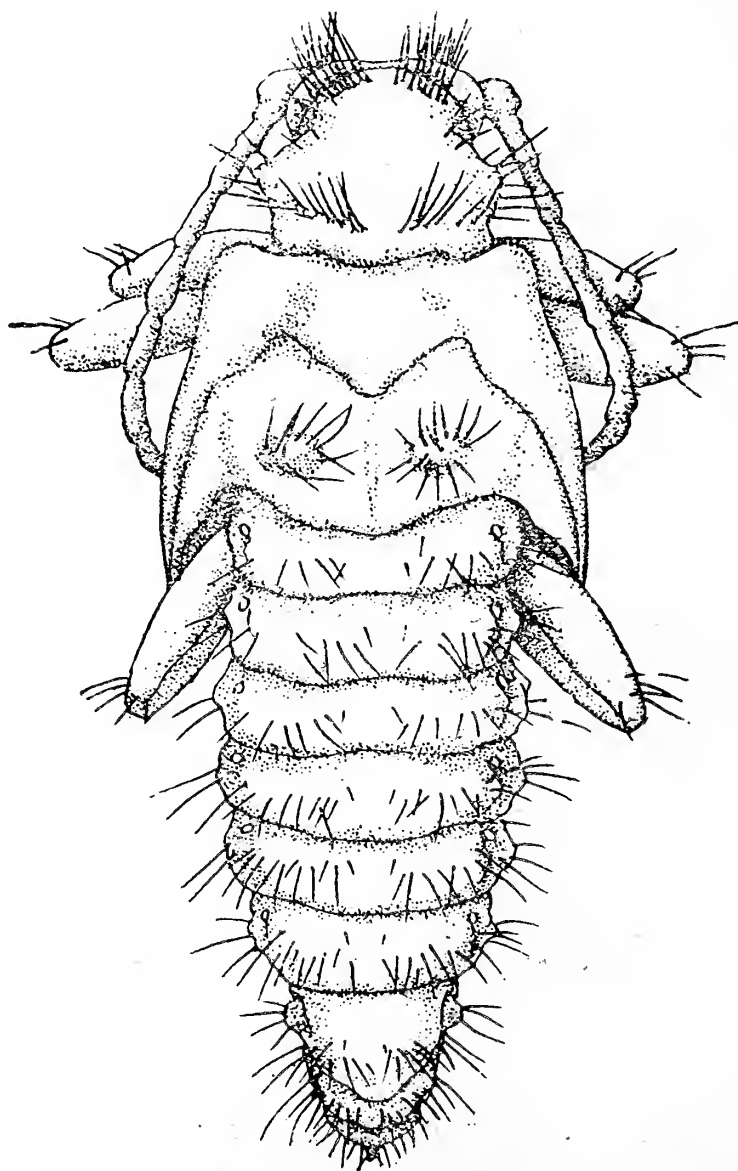


Figure 71. Pupa of *Gaurotes kozhevnikovi* Plav.

Abdominal tergites convex, with thin, rather short, piliform setae forming indistinct transverse row. Tip of abdomen slightly produced, sometimes almost rounded (dorsal view), with small light-colored non-sclerotized spinule, and on underside with triangular area bound laterally by small setaceous carina. Apex of hind femora with long setae forming transverse row. Valvifers of female hemispherical, well developed. Length 7.5 to 10.0 mm.

Material: Collected in Ussuri forests (Komarovka and Artemovka Rivers). Adult insects 17, including six raised in the laboratory, larvae 14, pupae 10, larval exuviae with beetles from pupal cell five.

Distribution: Ussuri-Primor'e region, northeast China, and North Korea.

Biology: Ecologically associated with coniferous species. Beetles found from end of June to mid-August. Female lays eggs in bark crevices on branches of dead and decaying pine and Korean maple. Sometimes colonizes broken or cut shoots up to 2.0 to 3.0 cm in diameter. Larvae live under bark, make meandering or flat galleries impressed in wood. Before second hibernation they make oval openings on surface of shoots, through which they fall onto soil, burrow into it, and make cell in which they remain for a second winter. Length of cell 8.0 mm, width 5.0 mm.

Larvae pupate in spring. Beetles emerge from pupae in two to three weeks and mature in cells for no more than five to seven days. Weight of III-instar larvae 27.5 to 45.3 mg, pupae 25.9 to 40.8 mg, adult insects 21.8 to 28.0 mg. According to laboratory observations, during metamorphosis (larva, pupa, adult) weight reduction graded in percentages was: females 100—95.5—77.9, and males 100—96.0—76.2, i.e., insect weight during this period dropped by 22.1% in females and 23.8% in males. Life cycle completed in two years.

3. *Gaurotes splendens* B. Jak.

B. Jakovlev, 1893, *Hor. Soc. Entom. Ross.*, vol. 27, p. 444; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 206–207 (*Gaurotina*).

Adult: Body stocky, comparatively thick. Head small, transversely convex between antennae, with smooth median longitudinal suture, dense large punctation between eyes, and sparse obliterated punctation in occipital region of cervix. Eyes small, finely faceted. Antennae proximate at base, with apices barely reaching middle of elytra; with minute hairs.

Pronotum not longer than width at base, narrows markedly toward front; with flange on anterior margin, at base with smooth transverse groove, laterally with obtuse comparatively large prominence, on disk laterally with distinct dents, medially with longitudinal groove; with

coarse rugose punctation and short golden-yellow hairs. Scutellum triangular, narrowly rounded and smooth posteriorly, with short sparse hairs in posterior half.

Elytra convex, with parallel sides, broadly rounded apically, with bent flattened margins; with very large merging punctation forming coarse wrinkles. Femora elongate, flattened, underside of apex without spine. Head, pronotum, and scutellum black; metathorax, abdomen, and legs light rust; tarsi and tibio-femoral joints blackened; antennae dark brown with rusty tinge; and elytra greenish. Length 16 mm, width at shoulders 7.0 mm.

Distribution: Trans-Baikal (Chikoi River). Only one beetle known from Chikoi River basin.

4. *Gaurotes magnifica* Plav.

Plavilstshikov [Plavil'shchikov], 1958, *Entomol. obozr.*, 37, 3, 720-721.

Adult (Figure 72): Differs from the proximate species *Gaurotes superba* (Ganglb.) in very large thick body and sparse hairs on pronotum. Head small, broadly impressed behind antennal bases between eyes, with uneven dense punctation, but smooth posteriorly, with sparse fine dots, and thin longitudinal suture between antennae. Antennae short, with apices barely reaching anterior third of elytra, with short adherent hairs; 3rd segment somewhat longer than 4th or equal to it.

Pronotum almost not longer than wide, with narrow flange on anterior margin, large obtuse tubercle laterally, coarse dense punctation on disk forming coarse striation, and sparse indistinct punctation and short rusty hairs on anterior flange. Scutellum moderately elongate, narrowly or broadly rounded posteriorly, with sparse minute punctation.

Elytra broad, convex, with parallel sides, generally rounded apically, margin behind humeri broadly bent under, and with coarse rugose punctation. Head, pronotum, scutellum, and underside of body black; legs and antennae dark brown with reddish-rust tinge. Elytra green
148 with metallic sheen (because of coarse lustrous striation elytra appear squarrose to naked eye). Length 17.5 to 18.0 mm, width at shoulders 7.0 mm.

Distribution: Ussuri-Primor'e region. Found close to Teren' Bay on coast of Sea of Okhotsk. Rare. Flight of beetles in June and July.

5. *Gaurotes superba* (Ganglb.)

Ganglbauer, 1889, *Hor. Soc. Entom. Ross.*, vol. 24, p. 50 (*Gaurotina*); Plavil'shchikov, 1958, *Entomol. obozr.*, 37, 3, 723 (*m. obscurithorax*, *m. sichotensis*).

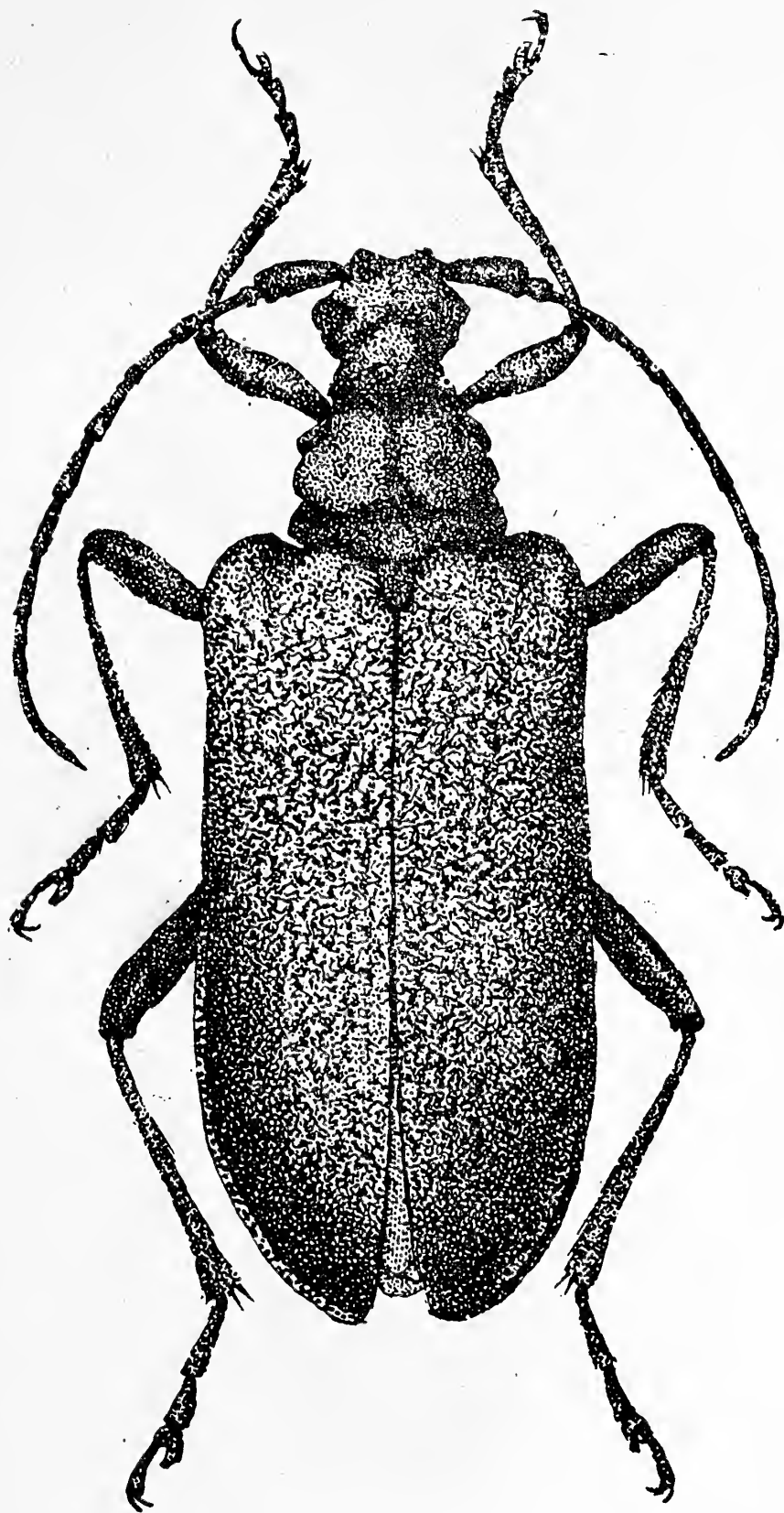


Figure 72. *Gaurotes magnifica* Plav.

Adult (Figure 73): Body elongate. Head behind eyes narrows insignificantly, with minute punctation, raised between antennae, smooth, without punctation here, with narrow median longitudinal suture, and with thin erect rusty hairs; temples indistinct, smooth, without punctation. Eyes small and convex, longitudinally elongate, finely faceted. Apices of antennae reach beyond 0.66 length of elytra; 4th segment not shorter, or only slightly shorter than 3rd.

Pronotum not longer or only slightly longer than width at base, with narrow flange on anterior margin, narrow transverse groove posterolaterally, closer to base with distinct obtuse tubercle, and with coarse dense punctation; disk laterally with notable impression; with dense erect, light-colored, slightly rusty and shaggy hairs (especially laterally). Scutellum narrow, elongate, narrows toward apex; with minute sparse punctation; longer than width at base.

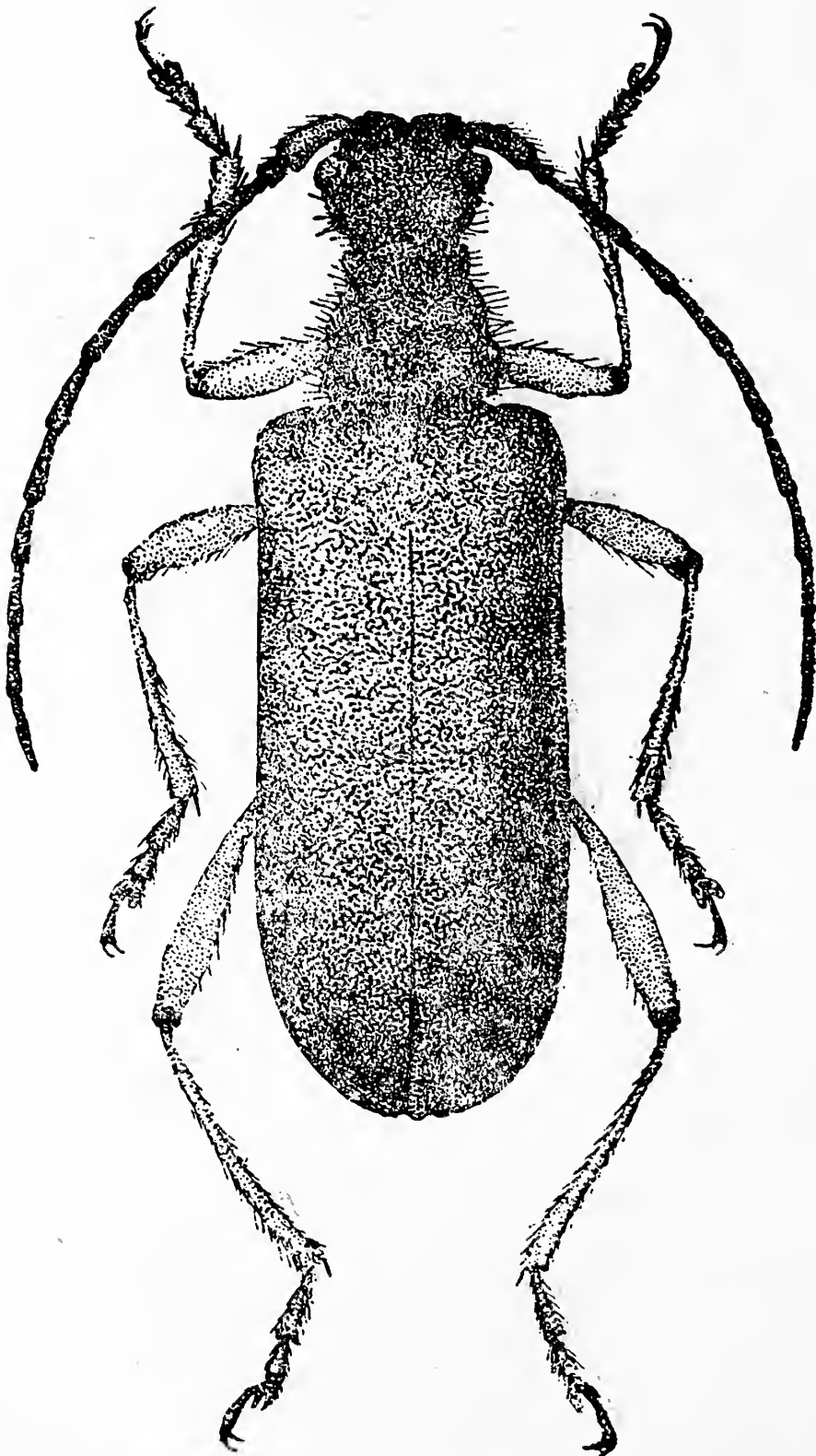


Figure 73. *Gaurotes superba* (Ganglb.).

Elytra elongate, with almost parallel sides, narrow slightly toward apex, generally rounded apically; with coarse, at places merging punctation that forms coarse striation, and sparse short semiadherent hairs that do not form compact cover. Femora smooth, without spinule on lower margin at apex. Head, prothorax, and scutellum black; meso- and metasterna, disk of abdominal sternites brownish; rest of abdomen and most of legs rusty; femora rusty, tarsi blackish-brown (m. *obscurithorax* Plav.), or entire abdomen, disk of metathorax and legs light rust with yellow tinge, trochanters and tarsi blackened (m. *sichotensis*). Elytra green with metallic sheen (appear squarrose). Length 14 mm, width at shoulders 5.5 mm.

Distribution: Ussuri-Primor'e region (Sikhote-Alin') and China (Hansu). Rare. Beetles sighted in July.

6. *Gaurotes ussuriensis* Bless.

Blessig, 1873, *Hor. Soc. Entom. Ross.*, p. 247; Plavil'shchikov, *Fauna SSSR*, 21, 1, 212-213.

Adult (Figure 74): Readily distinguished from preceding species by notch at elytral apex and color of femora. Body comparatively large, broad at shoulders. Head between antennae bulges transversely with
150 smooth narrow median longitudinal suture behind antennal base, and dense rugose punctation; temples slope gently, truncate, project slightly. Antennae extend beyond 0.50 (female) or 0.66 (male) length of elytra, matte toward apex from 6th segment; with minute short hairs. Third antennal segment longer than 4th, equal to 5th. Eyes markedly convex, not emarginate along inner side.

Pronotum short, its length barely less (female) or slightly more (male) than width, with small tubercle laterally, sharp flange on anterior margin, faint transverse groove at base, bulges on disk; with dense coarse punctation (punctures sometimes fuse, spaces between them not larger than punctures per se); with sparse adherent hairs, additional long erect hairs laterally, sometimes with median longitudinal groove.

Elytra broaden at humeri, narrow apically, compressed at base of humeri, and with raised inner side of anterior margin so that scutellum appears markedly crumpled, slightly flattened on disk, with dense large (especially in anterior third) punctation, sparse short adherent hairs; deeply notched at apex with sharp outer angles. Scutellum broad and triangular, with flat punctation and dense hairs. Legs comparatively
151 long; hind and midfemora on inner side at apex with perceptible spinule. Body black. Elytra greenish-bronze with metallic iridescence. Legs black, femora at base and hind and midtibiae often red on inner side. Antennae basally black, otherwise rusty. Length of body 9.0 to 13.0 mm.

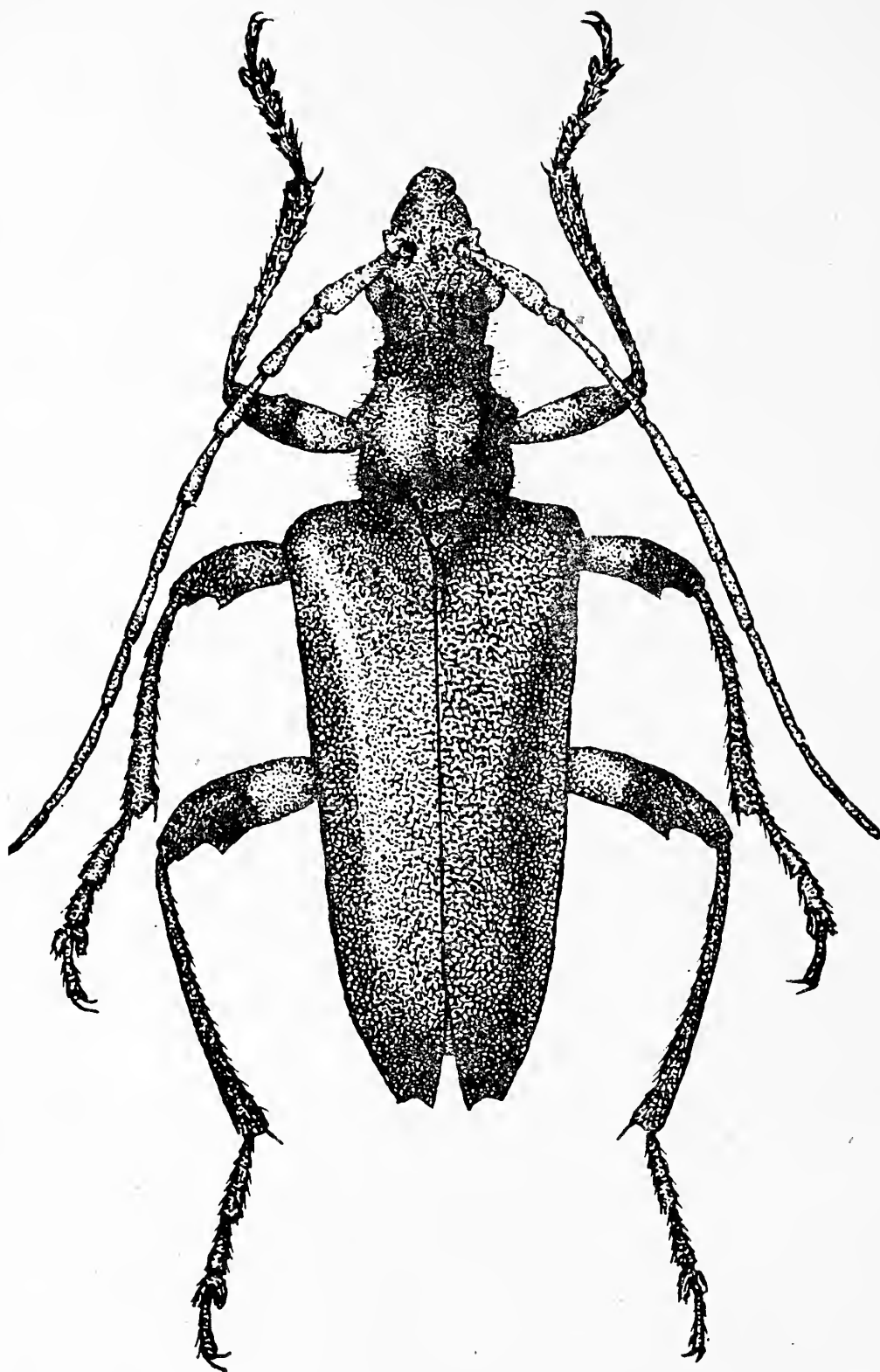


Figure 74. *Gaurotes ussuriensis* Bless.

Egg: White, elongate, obtusely rounded at poles, and with fine dense cellular sculpture. Length 1.1 mm, width about 0.4 mm.

Larva (Figure 75): Differs from larvae of other species of this genus in short lateral hypostomal sutures. Head transverse, slightly retracted into prothorax. Epistoma narrowly rounded posteriorly, laterally at apex narrows markedly into projection and here with pair of short thick setae; bound by distinct whitish frontal sutures, divided by transverse white band, and curved medially; flexure with longitudinal brownish

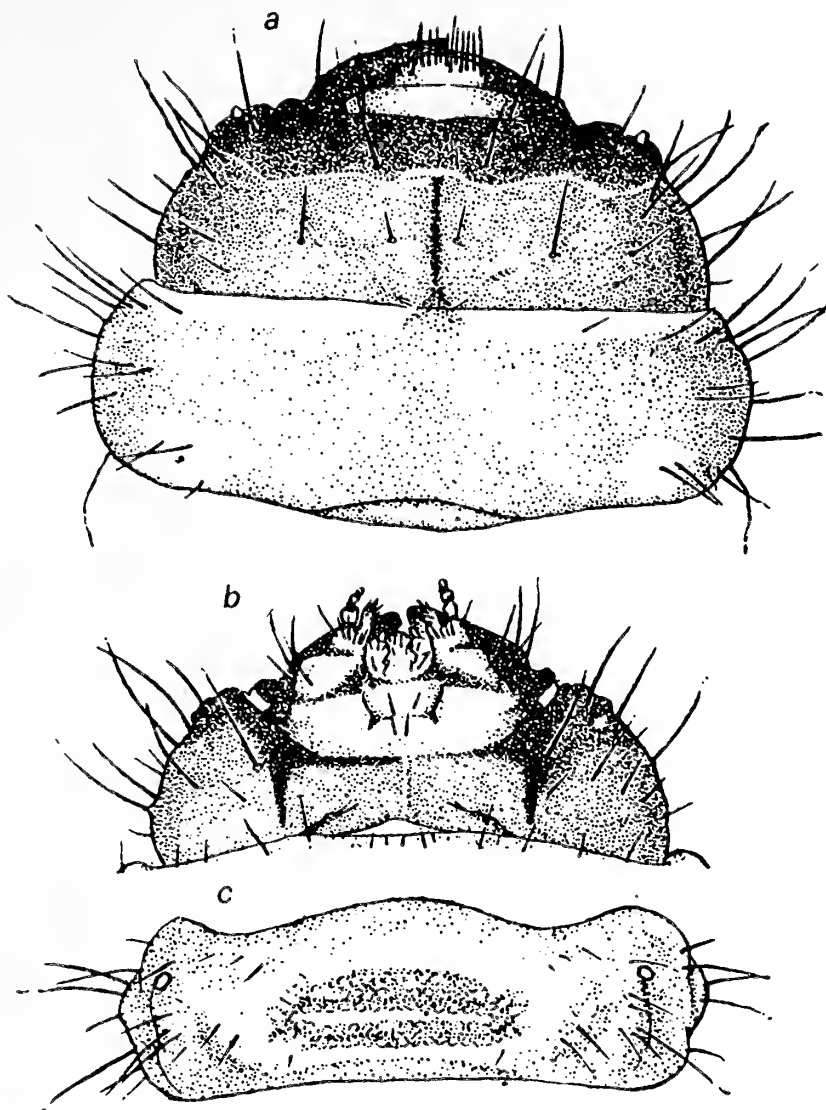


Figure 75. Larva of *Gaurotes ussuriensis* Bless.

a—head and pronotum; b—head (ventral view); c—abdominal tergite with dorsal locomotory ampulla.

suture (sutura medialis). Hypostoma broad, with parallel sides, narrow median longitudinal white band (striae); lateral sutures 0.25 width at anterior margin. Temporo-parietal lobes with long sparse setae. Ocelli around antennal bases pigmented, form narrow band. Clypeus broad, flattened. Labrum small, transversely oval, with short coarse setae on anterior margin. Mandibles comparatively thick, slightly elongate, obliquely truncate or slightly notched apically.

Pronotum short, slightly convex on disk, almost flat, with distinct (large) wrinkles extending backward from middle of anterior margin laterally, long stray piliform setae laterally forming distinct transverse row on anterior margin. Prothoracic eusternum in anterior half with three pairs of setae displaced laterally; of these, anterior and posterior pairs consist of large setae, and middle pair of minute setae. Legs developed; claws thin, sharp, and rusty.

Abdomen broad, underside markedly flattened, narrows slightly

posteriorly, with distinct apical spinule more sclerotized at tip. Dorsal locomotory ampullae with minute smooth granules forming four transverse rows; sometimes additional fifth row visible. Ventral locomotory ampullae with two rows of obliquely elongate granules (especially laterally); short setae form sparse transverse band in front of anterior row. Body white. Head rusty-red. Mandibles black. Anterior half and sides of pronotum yellowish. Body length of III-instar larvae 16 to 17 mm, width of head 3.5 mm.

Interstadial changes: in I-instar larvae transverse white band on epistoma lacking, but present in II- and particularly III-instar larvae. Lateral sutures of hypostoma comparatively long, about 0.33 width at anterior margin. Apex of abdominal segment IX produced into long sharp, slightly upturned spine. In III-instar larvae hypostoma broader, lateral sutures in relation to width considerably shorter, apical projection of abdominal segment IX disappears, and spinule becomes relatively short and thick.

Pupa (Figure 76): Differs from pupa of *Gaurotes suvorovi* Sem. in rather indistinct flange on anterior margin of pronotum, narrow triangular area on tip of abdomen of male (ventral view), and distinctly hemispherical valvifers of female. Body considerably curved. Head elongate, between antennae transversely convex, antennal bases (on inner side) with three or four setae, with tuft of setae behind eyes. Antennae in second half curved, annular.

Pronotum almost transverse, narrows anteriorly, with distinctly broad but not sharp (especially laterally) flange on anterior margin; with 10 to 14 long thick setae on markedly raised anterior margin and 13 to 16 such setae on nonraised posterior margin forming dense paramedial transverse row, very thin setae laterally. Mesonotum glabrous, transversely striate. Metanotum with pair of round tubercular prominences and covered with thick coarse setae.

Abdominal tergites bulge on posterior margin, with long paramedial setae forming indistinct transverse row interrupted medially. Tip of abdomen considerably bent down, at end with indistinct spinescent projection, laterally with long dense hairs, ventrally in male with markedly narrow elongate triangular zone bound laterally by faint densely pubescent carina. Hind femora with 18 setae apically, usually forming two transverse rows. Valvifers of female large, hemispherical, with faint papilliform apical projection. Length 9.0 to 14.0 mm.

Material: Collected in forests of Ussuri-Primor'e region. Adult insects 580, larvae 335, pupae 14.

Distribution: Ussuri-Primor'e region, extending west up to confluence of Shilka and Arguna Rivers; northeast China and North Korea. Found neither on Sakhalin nor islands of southern Kuril' group; substituted here by another proximate species, *Gaurotes suvorovi* Sem.

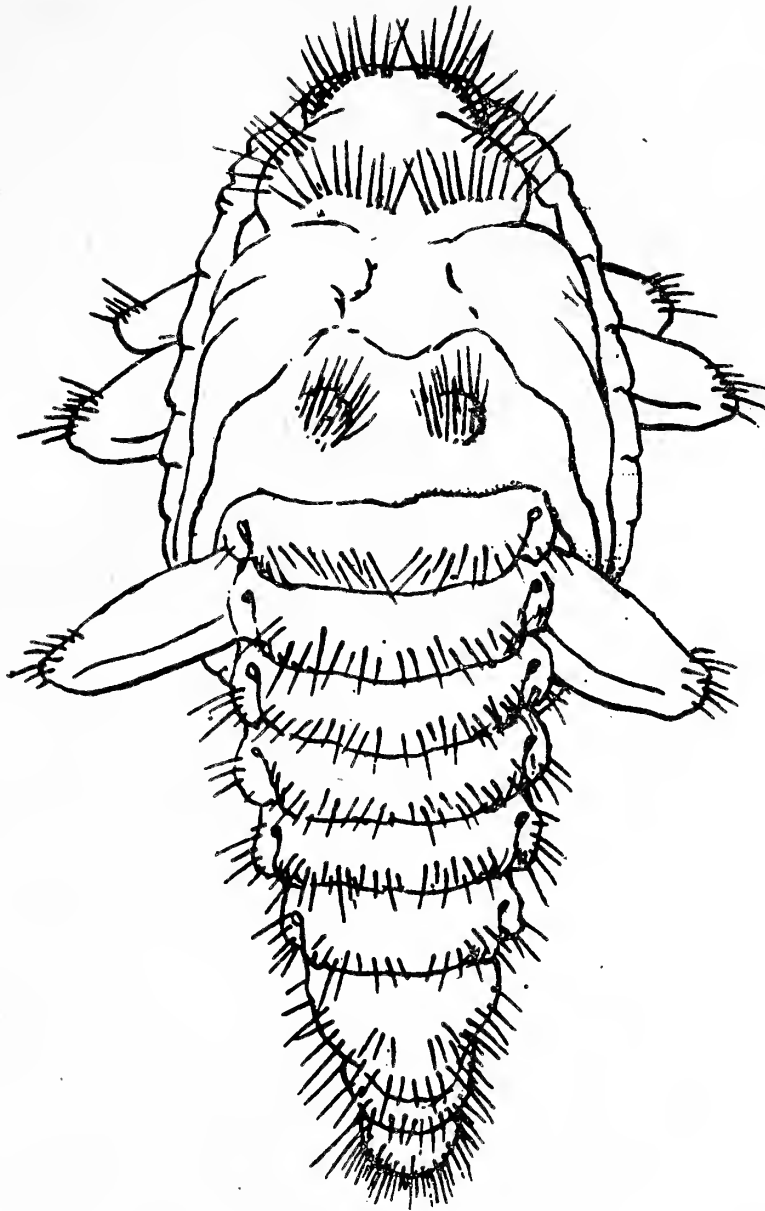


Figure 76. Pupa of *Gaurotes ussuriensis* Bless.

Biology: Ecologically associated with broad-leaved forests. Flight observed in June and July, with beetles maximum mid-June. They often feed on pollen and flower petals. Female lays eggs in bark crevices on trunks and thick branches of decaying, dead, and wind-fallen trees, often colonizing stumps with desiccated bark. Sometimes several eggs are laid in a single oviposition at the same site. Under natural conditions development of eggs from time of oviposition to hatching of larvae takes 12 to 19 days.

Larvae live under bark, damage bast, and make longitudinal meandering galleries without touching alburnum. Before second hibernation III-instar larvae bite oval holes and fall through them to the ground. They burrow into soil to a depth of 3.0 to 5.0 cm, make pupal cell by rotatory body movements, and overwinter in it. Length of pupal cell 10 to 15 mm, width up to 8.0 mm.

Pupation occurs in May. Pupae found in soil up to middle 10 days

of June. Pupal development occurs at a soil temperature of 10 to 12°C. Pupae maximum end of May. Young beetles appear early June and remain in cells for a week. En masse emergence of beetles from soil occurs mid-June. After emerging from soil, beetles live on the average for not more than two to three weeks. Some die after four weeks. Weight of larvae before pupation 53.0 to 152.9 mg, pupae 44.0 to 102.7 mg, and adult insects 32 to 62 mg (possibly more). Life cycle completed in two years. Under laboratory conditions at room temperature the life cycle was completed in 11 months (from June 17, 1972 through May 15, 1973). This species colonizes mainly Manchurian walnut, rarely other deciduous species. Counts of insects revealed: on Manchurian walnut 213, elm 18, maple 10, oak nine, bird-cherry seven, apricot six, *Eleutherococcus* two, and alder one. Often found in large numbers; attacks only decaying and dead trees.

7. *Gaurotes suvorovi* Sem.

Semenov, 1914, *Rus. entomol. obozr.*, 14, 1, 17; Kojima and Haya-shi, 1969, *Insect Life in Japan*, vol. 1, p. 12 (*G. doris* Bat., ab. *suvorovi*); Krivolutskaya, 1966, *Vrednye nasekomye lesov Sovetskogo Dal'nego Vostoka*, p. 52 (*G. ussuriensis* Bless); Krivolutskaya, 1973, *Entomofauna Kuril'skikh ostrovov*, p. 99.

Adult (Figure 77): Proximate to *Gaurotes ussuriensis* Bless. Readily distinguished from it by bright green elytra, more projecting spines on femoral apices, and other features. Head with dense punctation, adherent hairs; frons between antennae with deep longitudinal suture; temples slope gently, with long erect hairs. Apices of antennae reach beyond 0.50 (female) or 0.66 (male) length of elytra.

Pronotum markedly narrows anteriorly, with sharp flange at anterior margin, sometimes with distinct transverse groove at base, tubercularly convex on disk, with more or less distinct median longitudinal groove, dense but not compact punctation (distance between punctures usually as large as punctures per se) and light-colored adherent hairs. Scutellum broad and triangular, with dense closely adherent hair cover.

Elytra narrow slightly posteriorly (female) or markedly (male), notched apically, on inner side of humeral tubercle notably compressed at base, 154 with inner anterior margin of scutum very slightly raised; with large deep punctation forming transverse striation. Legs comparatively long, apices of hind and midfemora on underside with sharply projecting acute dentate spine. Underside of thorax (especially in male) with long dense light-colored hairs. Abdominal sternites convex, with sparse hairs that do not form compact cover. Body black, elytra bright green with metallic sheen. Legs black, first half of femora light yellow with rusty tinge. Antennae dark brown, almost black. Length of body 11 to 15 mm.

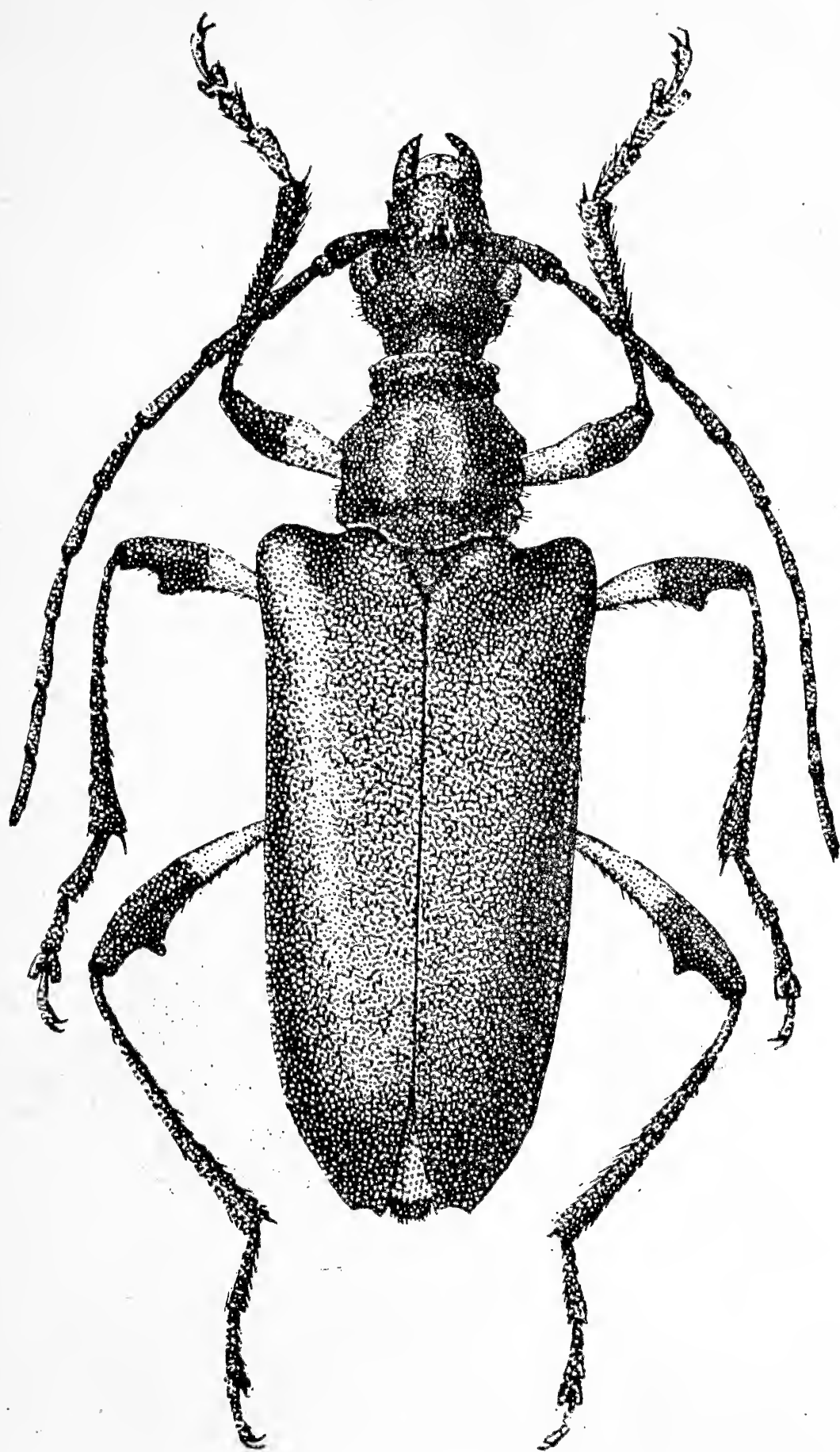


Figure 77. *Gaurotes suvorovi* Sem.

Egg: White, elongate, obtusely rounded at poles, narrows gently toward one end, more steeply toward the other. Chorion with dense
155 deep fine cellular sculpture. Length 1.1 to 1.3 mm, width 0.3 to 0.4 mm.

Larva (Figure 78): Very similar to larvae of other species of the genus *Gaurotos*. Body comparatively large. Head transverse, flat, and rounded laterally. Parietals dorsally with setaceous pores forming longitudinal row. Epistoma with well-developed whitish frontal sutures joined in front by transverse white band bisected by brownish longitudinal suture (sutura medialis); sides of latter bound by median longitudinal depression and here, before transverse white band, deep setaceous pore located. Hypostoma barely perceptible in front or narrows almost imperceptibly, with median longitudinal white band, and oblique dents at base. Clypeus broadly trapezoidal, smooth basally, with pair of setae laterally. Labrum basally with pair of long setae, on anterior margin with short coarse setae. Mandibles long, elongate, lustrous on outer side, with transverse matte band in middle, and apically obliquely truncate and distinctly produced.

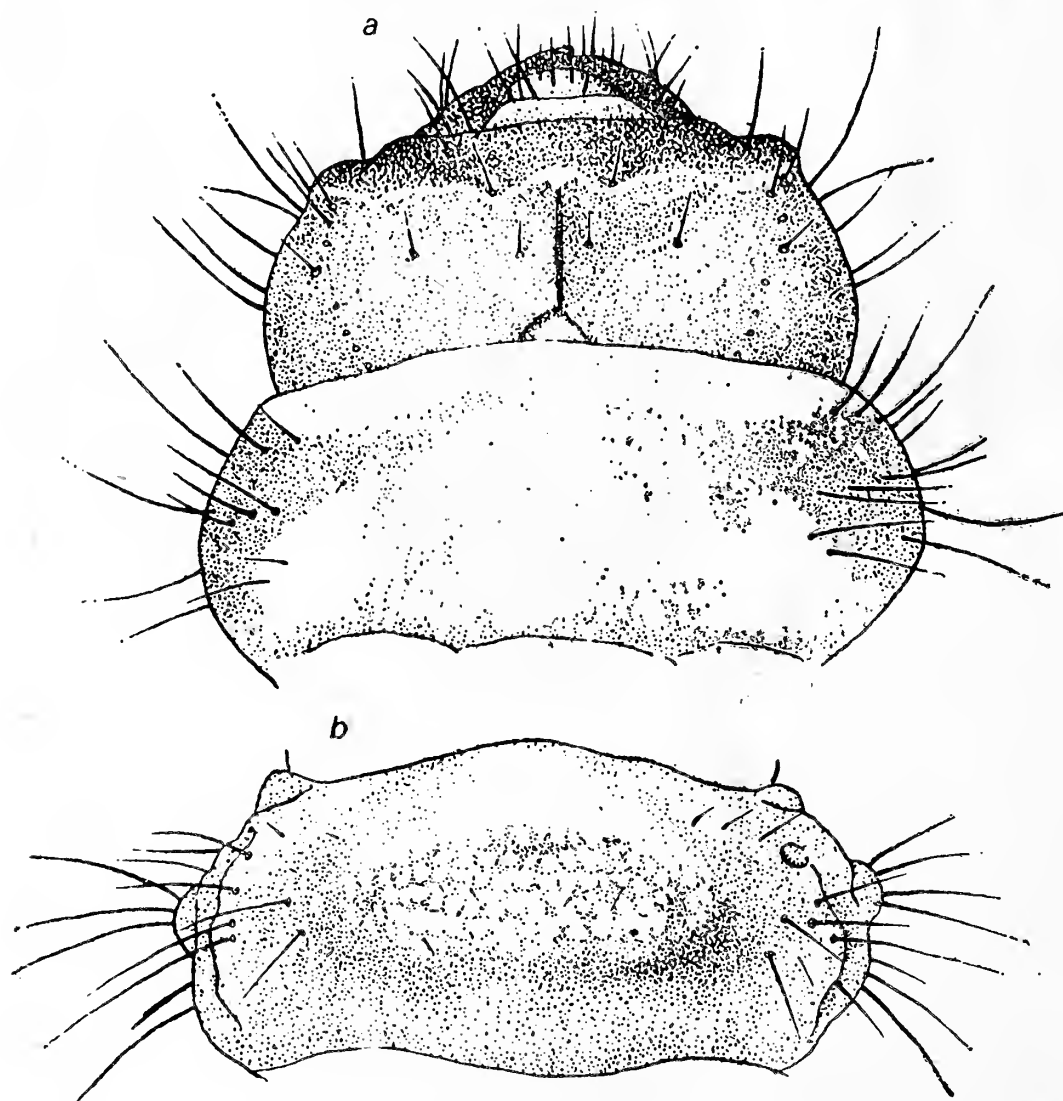


Figure 78. Larva of *Gaurotos suvorovi* Sem.

a—head and pronotum; b—abdominal tergite
with locomotory ampulla.

Pronotum transversely elongate, laterally in anterior half with long setaceous hairs forming transverse row. Pronotal shield not demarcated from general surface, without lateral folds, flat and smooth. Prosternum glabrous, with stray setae; eusternum broadly rounded anteriorly, with two pairs of widely separated setae (displaced laterally) in anterior half. Thoracic legs comparatively short, with minute claws and sparse thin piliform setae.

156 Abdomen elongate, flattened ventrally, with long setaceous hairs laterally. Dorsal locomotory ampullae with granules forming four transverse rows. Ventral locomotory ampullae with two transverse rows of granules that are medially proximate but shifted laterally. Apex of abdominal tergite IX with long well-developed spinule. Length of III-instar larva up to 20 mm, width of head about 3.0 mm.

Pupa (Figure 79): Body slightly curved. Head elongate and markedly bent under; around antennal bases on inner and front sides with three long thick (male) or thin (female) setae, behind eyes with tuft of setae. Antennae flexed to sides, turned ventrad behind midfemora.

Pronotum enlarges toward base, markedly narrows anteriorly, with sharp flange on anterior margin, bulging and smooth on disk; long thick setae on posterior and anterior margins set on tubercles form dense transverse row, advanced more toward head in male. Metanotum with two tufts of paramedial setae on tubercular protuberances. Apex of femora with long thin setae.

Abdomen elongate, narrows toward apex. Abdominal tergites convex, with long thin setae on posterior margin. Tip of abdomen produced in papilliform process; with dense long piliform setae, triangular area ventrally, and laterally bound by setaceous (pubescent) carina. Apices of hind femora with long setae forming tuft. Valvifers of female large, apically produced somewhat laterally. Length of body 10 to 13 mm.

Material: Collected on Sakhalin and Kunashir. Adult insects 56, larvae 34, pupae nine, larval exuviae from cells six.

Distribution: Sakhalin, Kunashir, Iturup; Japan (Hokkaido and Honshu). Classifying this species as an aberrant form of *Gaurotes doris* Bat. (ab. *suvorovi*) is not correct; *G. suvorovi* Sem. represents a fully evolved insular species, which differs in characteristic morphological and biological features. It is essentially a vicarious relative of *G. ussuriensis* Bless. inhabiting the continental Far East.

157 *Biology*: Inhabits broad-leaved forests. Flight of beetles commences from end of June-early July and ceases in August. Beetles emerge from cells with underdeveloped gonads and require supplementary feeding; they feed on flowers of Umbelliferae and other plants. Seen in large numbers in last 10 days of July. Female lays eggs in bark crevices on trunks and thick branches, and is capable of laying up to 107 eggs in

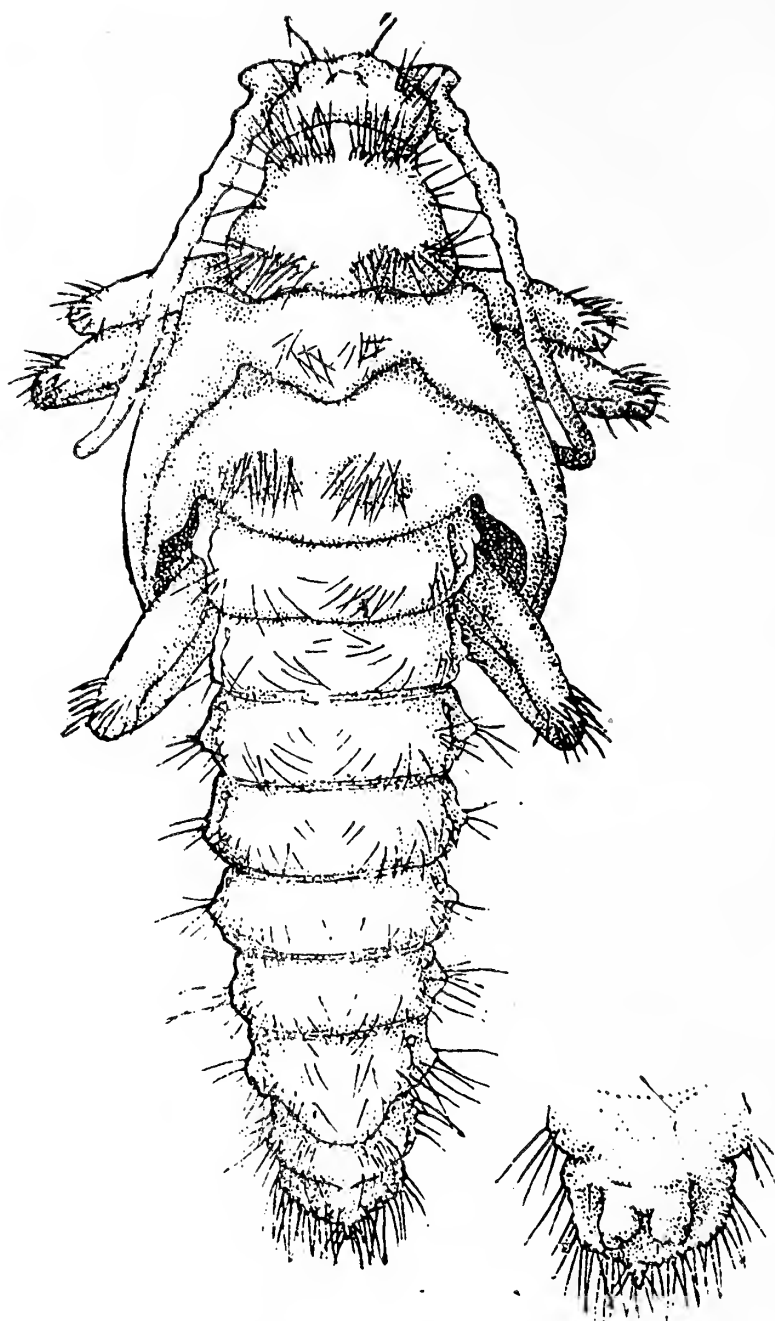


Figure 79. Pupa of *Gaurotes suvorovi* Sem., female.

her lifetime. Colonizes maple, mountain ash, Japanese alder, oak, elm, willow, and other deciduous species. One larvae found on birch.

Young larvae detected in August and September; they bore into bark, make meandering galleries under bark without impressing alburnum, and plug them with frass. Larvae live under bark for not less than a year; later, in the last instar, they bite oval openings on the surface, emerge through them, burrow into soil, make a pupal cell there, and enter diapause. Length of pupal cell 10 to 12 mm, width up to 8.0 mm. Cells porous, highly friable during excavation. Pupation of larvae occurs after second hibernation, from end of May to middle 10 days of June inclusive. Pupae found up to July. Young beetles in pupal cells found from last 10 days of June. Weight of larvae in soil 74.5 to 118.0 mg, pupae 72 to 108 mg, adult insects 62.5 to 86.4 mg. Numbers maximum in sparse well-warmed vegetation.

10. Genus *Lemula* Bat.

Bates, 1884, *J. Linn. Soc. Lond. Zool.*, vol. 18, p. 211; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 213-214; Gressitt, 1951, *Longicorn Beetles of China*, vol. 2, pp. 66-67; Kojima and Hayashi, 1969, *Insect Life in Japan*, vol. 1, p. 13; Nakane, 1974, *Beetles of Japan*, vol. 12, pp. 5-6.

Proximate to the genus *Acmaeops*.

Adult: Distinguished by small size, narrow short pronotum, comparatively convex body, with parallel sides, and elytra generally rounded apically.

In USSR fauna this genus is represented by one species, in Japan and China four each, and Taiwan two.

Type species: *Lemula decipiens* Bates, 1884.

1. *Lemula decipiens* Bat.

Bates, 1884, *J. Linn. Soc. Lond. Zool.*, vol. 18, p. 212; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 214-215; Kojima and Hayashi, 1969, *Insect Life in Japan*, p. 13.

Adult (Figure 80): Body small, slightly elongate. Head short, sharply narrows posteriorly, with projecting rounded temples; deep punctation (spaces between punctures with fine shagreen sculpture), and long erect hairs on temples. Eyes markedly convex, without perceptible emargination. Antennae thin, with apices reaching beyond 0.66 length of elytra.

Pronotum considerably narrower than elytra, basally wider than long, with sharp narrow flange on anterior margin, transverse groove at base, small tubercle on each side, deep smooth longitudinal groove in middle, and disk paramedially raised, tubercular; with moderate not very large punctation (spaces between punctures and base of longitudinal groove with fine shagreen sculpture) and with tender sparse hairs. Scutellum short, almost semicircular, lustrous.

Elytra convex, with parallel sides; apically generally rounded; with large deep rugose punctation and very sparse light-colored short hairs. Legs comparatively long, with short dense hairs; hind tarsi markedly shorter than tibiae. Body black, antennae dark brown, light rust at base. Legs dark brown or black, femora basally light rust. Tip of abdomen rusty. Length 6.0 to 7.0 mm.

Distribution: Ussuri-Primor'e region, Sakhalin; Japan, eastern China, and Taiwan.

Biology: Inhabits mixed and deciduous vegetation. According to Japanese authors (Kojima and Okabe, 1960), ecologically associated with *Cornus controversa*. Flight of beetles observed in June and July. The description of this species is based on the collection in Moscow State University.

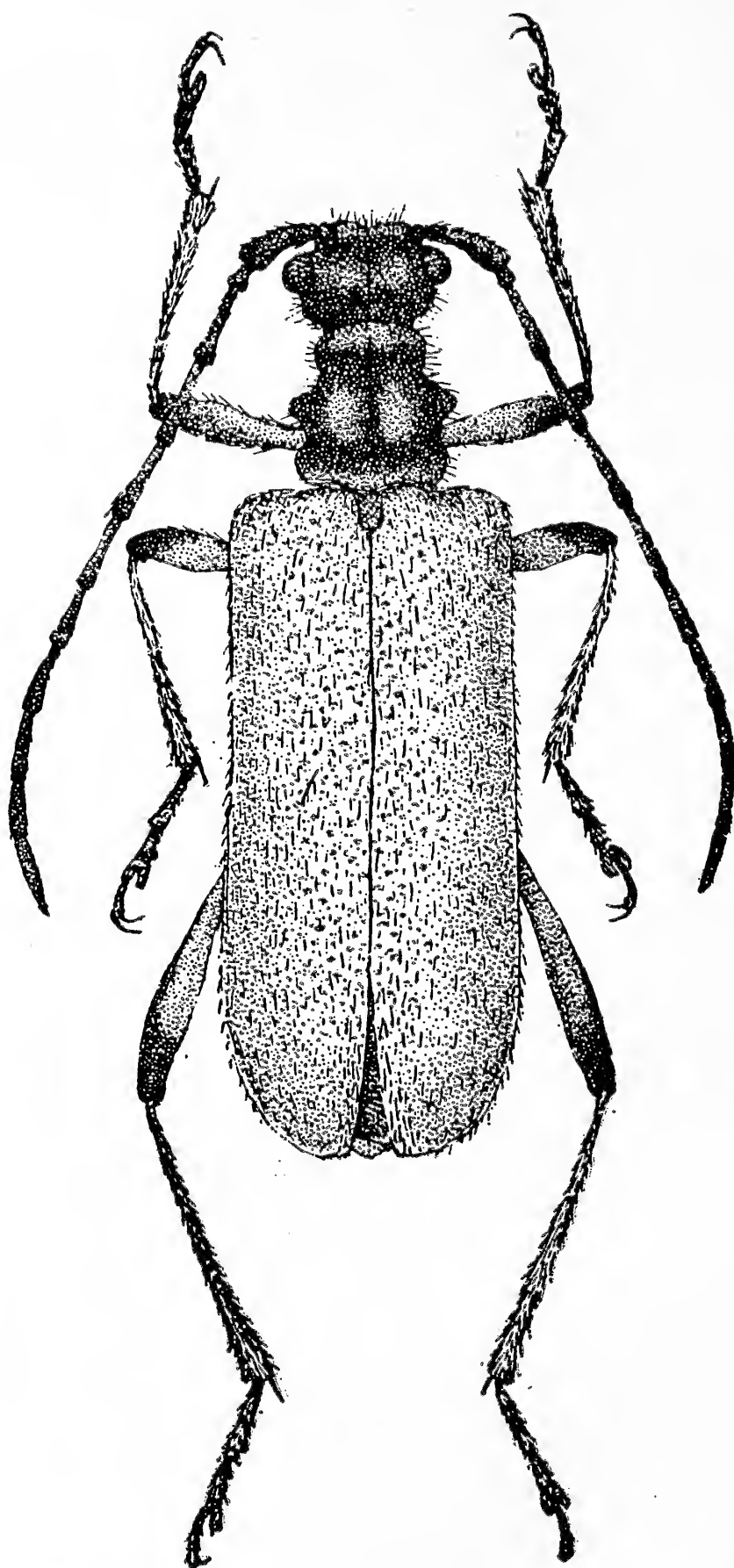


Figure 80. *Lemula decipiens* Bat.

11. Genus *Acmaeops* LeConte

LeConte, 1850. In Agassiz's *Lake Sup.*, p. 235; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 207–208; Demelt, 1951, *Die Tierwelt Deutsch.*, vol. 2, p. 38; Gressit, 1951, *Longicorn Beetles of China*, vol. 2, p. 60; Kojima and Hayashi, 1969, *Insects Life in Japan, Longicorn Beetles*, vol. 1, p. 13; Linsley and Chemsak, 1972, *Cerambycidae of North America*, p. 135 (*Gnathacmaeops*).

Adult: Body stocky, comparatively small. Prothorax laterally rounded, without protuberances. Pronotum markedly narrows anteriorly, with broad flange on anterior margin (*Acmaeops*) or without it (*Dinoptera*).

Larva: Body flat. Apical spinule on abdominal segment IX absent. Locomotory ampullae with granules. Pronotum laterally in anterior half with smoky-black spot (*Dinoptera*) or without it (*Acmaeops*). Thoracic legs well developed.

Pupa: Body small, slightly curved. Head markedly bent under and elongate. Antennae short, curve around midfemora. Pronotum with broad flange on anterior margin (*Acmaeops*) or without it and more convex (*Dinoptera*).

The genus *Acmaeops* is widely distributed in Eurasia and North America. Of the 11 species recorded in the USSR, nine inhabit the forests of Siberia and the Far East. Larvae live under bark of coniferous (*Acmaeops*) or deciduous (*Dinoptera*) species. Larvae of some species [*A. septentrionis* (Thoms.), *A. minuta* (Gehl.)] burrow into soil for pupation, while others [*A. angusticollis* (Gehl.)] remain under bark and line pupal cell with fibrous frass. A characteristic feature of all species of the genus *Acmaeops* is the preference of larvae to live in bark. Galleries made by them inside bark are generally not impressed on alburnum.

Type species: *Leptura proteus* Kirby, 1937.

KEY TO SPECIES

Adult Insects

- 1 (12). Pronotum with sharp flange on anterior margin.
- 2 (3). Elytra with raised humeri that distinctly project forward, appear wider at this level (subgenus *Gnathacmaeops*). 1. ***A. pratensis*** (Laich.)..
- 3 (2). Elytra with rounded, slightly raised humeri (*Acmaeops* s. str.).
- 4 (5). Elytra notched apically, with acutely produced angles. Legs bicolored; femora black or dark brown, tibiae light rust. 2. ***A. marginata*** (F.).
- 5 (4). Elytra notched apically or slightly obtuse, with rounded angles,

rarely with acutely produced inner angle. Legs monochromatic; usually dark brown or black, or entirely rusty.

- 6 (11). Body black; elytra sometimes light rust.
- 7 (8). Pronotum with dense adherent hair cover, with stray erect hairs only laterally. 3. *A. angusticollis* (Gehl.).
- 8 (7). Pronotum with adherent and dense erect hairs.
- 9 (10). Elytra black with reddish-rust border laterally or entirely light rust, with minute grayish hairs. 4. *A. septentrionis* (Thoms.).
- 10 (9). Elytra black, without light-colored border laterally, with greenish, rarely grayish hairs. 5. *A. smaragdula* (F.).
- 11 (6). Body more rusty; elytra invariably rusty, with yellow-golden hairs. 6. *A. sachalinensis* Tsher.
- 12 (1). Pronotum without sharp flange on anterior margin (subgenus *Dinoptera*).
- 13 (16). Pronotum black.
- 14 (15). Elytra with metallic bluish iridescence. 7. *A. minuta* (Gehl.).
- 15 (14). Elytra black, without metallic bluish iridescence. 8. *A. anthracina* (Mannh.).
- 16 (13). Pronotum red 9. *A. collaris* (L.).

Larvae

- 1 (10). Pronotum laterally without black spot. Found on coniferous species.
- 2 (7). Abdominal sternite IX with sparse stray paramedial hairs that do not form extensive field. If with large number of hairs [*A. marginata* (F.)], then abdominal tergites posterior to dorsal locomotory ampullae laterally with single large setaceous hair.
- 3 (4). Epistoma broadly rounded apically. Abdominal sternite IX in anterior half usually without hairs or with one to two hairs. Found mainly on spruce. 1. *A. pratensis* (Laich.).
- 4 (3). Epistoma narrowly rounded or pointed apically. Abdominal sternite IX in anterior half invariably with hairs.
- 5 (6). Abdominal tergite IX laterally, especially in III-instar larvae, flattened, with carinate edges; apex with quite dense setaceous hairs forming tuft. Anterior half of abdominal sternite IX with two to six lateral hairs. Found mainly on common pine. 2. *A. marginata* (F.).
- 6 (5). Abdominal tergite IX laterally, even in III-instar larvae not flattened, without perceptible carinate edges; apex and also sides with thin setaceous (long) hairs that do not form tuft.

- Anterior half of abdominal sternite IX with one hair on each side. Found mainly on maple. . . . 3. **A. angusticollis** (Gehl.)
- 7 (2). Abdominal sternite IX with dense paramedial setaceous hairs forming extensive field. Abdominal tergites posterior to dorsal locomotory ampullae laterally with three hairs, of which large one located at posterior angle of ampulla and two somewhat smaller on inner side.
- 8 (9). Abdominal tergite IX in last-instar larvae distinctly transverse, with basal width 1.5 to 2.0 times length. Pubescent field on anterior margin of sternite IX usually medially interrupted by smooth glabrous area. Dorsal locomotory ampullae usually rounded laterally, transversely oval. Found on larch, maple, and other coniferous species. 4. **A. septentrionis** (Thoms.).
- 9 (8). Abdominal tergite IX, even in last-instar larvae usually not transverse, its basal width not more than its length. Pubescent field on abdominal sternite IX generally continuous, not medially interrupted on anterior margin. Dorsal locomotory ampullae broaden laterally from behind, transversely trapezoidal. Found on maple and other coniferous species. 5. **A. smaragdula** (F.)
- 10 (1). Pronotum laterally with well-demarcated smoky-black spot (subgenus *Dinoptera*). Found on deciduous species.
- 11 (12). Setaceous hairs on tip of abdomen thick, coarse, light brown or rusty. Basal width of abdominal tergite IX usually not more or only slightly more than its length. Found on ash and other broad-leaved trees. Ussuri-Primor'e region. 7. **A. minuta** (Gehl.).
- 12 (11). Setaceous hairs on tip of abdomen thin and lighter in color. Basal width of abdominal tergite IX considerably more than its length. Found on poplar and other deciduous species. Altai and Europe. 9. **A. collaris** (L.).

161 **Pupae**

- 1 (8). Pronotum with broad flange in anterior third and distinct transverse groove on anterior margin (subgenus *Acmaeops*).
- 2 (5). Mesonotum glabrous, without setae; if with setae, those on posterior margin of pronotum form continuous row, not medially interrupted.
- 3 (4). Tip of abdomen without distinct spinule, slightly sclerotized. Mesonotum glabrous, without setae. Setae on posterior margin of pronotum form discontinuous, medially interrupted row. 2. **A. marginata** (F.).

- 4 (3). Tip of abdomen with elongate spinule. Mesonotum with setae. Setae on posterior margin of pronotum form continuous row, not interrupted medially. 3. **A. angusticollis** (Gehl.).
- 5 (2). Mesonotum with tender thin setae forming two small tufts. Setae on pronotal base form transverse row, widely interrupted medially.
- 6 (7). Row of setae at base of pronotum curves backward markedly. Abdominal tergite VIII with setae forming transverse band. 4. **A. septentrionis** (Thoms.).
- 7 (6). Row of setae at base of pronotum almost straight, curves backward slightly. Abdominal tergite VIII with setae forming distinct transverse row. 5. **A. smaragdula** (F.)
- 8 (1). Pronotum without flange in anterior third; anterior margin smooth, without transverse groove (subgenus *Dinoptera*).
- 9 (10). Setae on posterior margin of pronotum without perceptibly produced coriaceous base. 7. **A. minuta** (Gehl.).
- 10 (9). Setae on posterior margin of pronotum with distinct, highly produced coriaceous base. 9. **A. collaris** (L.).

1. **Acmaeops pratensis** (Laich.)

Laicharting, 1784, *Tirol. Insect.*, vol. 2, p. 172 (*Leptura*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 220–221; Gressitt, 1951, *Longicorn Beetles of China*, vol. 2, pp. 68–69; Demelt, 1966, *Die Tierwelt Deutsch.*, pp. 38–40; Linsley and Chemsak, 1972, *Cerambycidae of North America*, 4, 1, 136–137 (*Gnathacmaeops*).

Adult (Figure 81): Differs from other species in better developed humeral tubercles of elytra and absence of sessile hair cover on head and pronotum. Body stocky. Head with dense large punctation and long erect hairs; narrows gradually behind eyes. Antennal apices reach beyond middle of elytra (male) or do not reach this level (female).

Pronotum convex, on disk with faint longitudinal groove, moderately punctate, markedly narrows anteriorly, with sharp flange on anterior margin, distinct transverse groove at base, slightly bent anterior margin, distinctly edged along posterior margin; with long thin erect hairs. Scutellum triangular, produced posteriorly, narrowly rounded at apex, and with fairly dense punctation.

Elytra broaden at humeri, with projecting humeral tubercles, truncate apically, somewhat produced at inner angles; with dense punctation and semiadherent light-colored hairs. Hind tibiae slender, thicken slightly apically, considerably longer than tarsi; 1st tarsal segment 2.0 times longer than 2nd. Body black. Antennae black, matte. Legs black. Elytra straw-yellow, suture, apex, and band extending posteriorly from humeral tubercles on disk blackish-brown or black (f. *typica*); some-

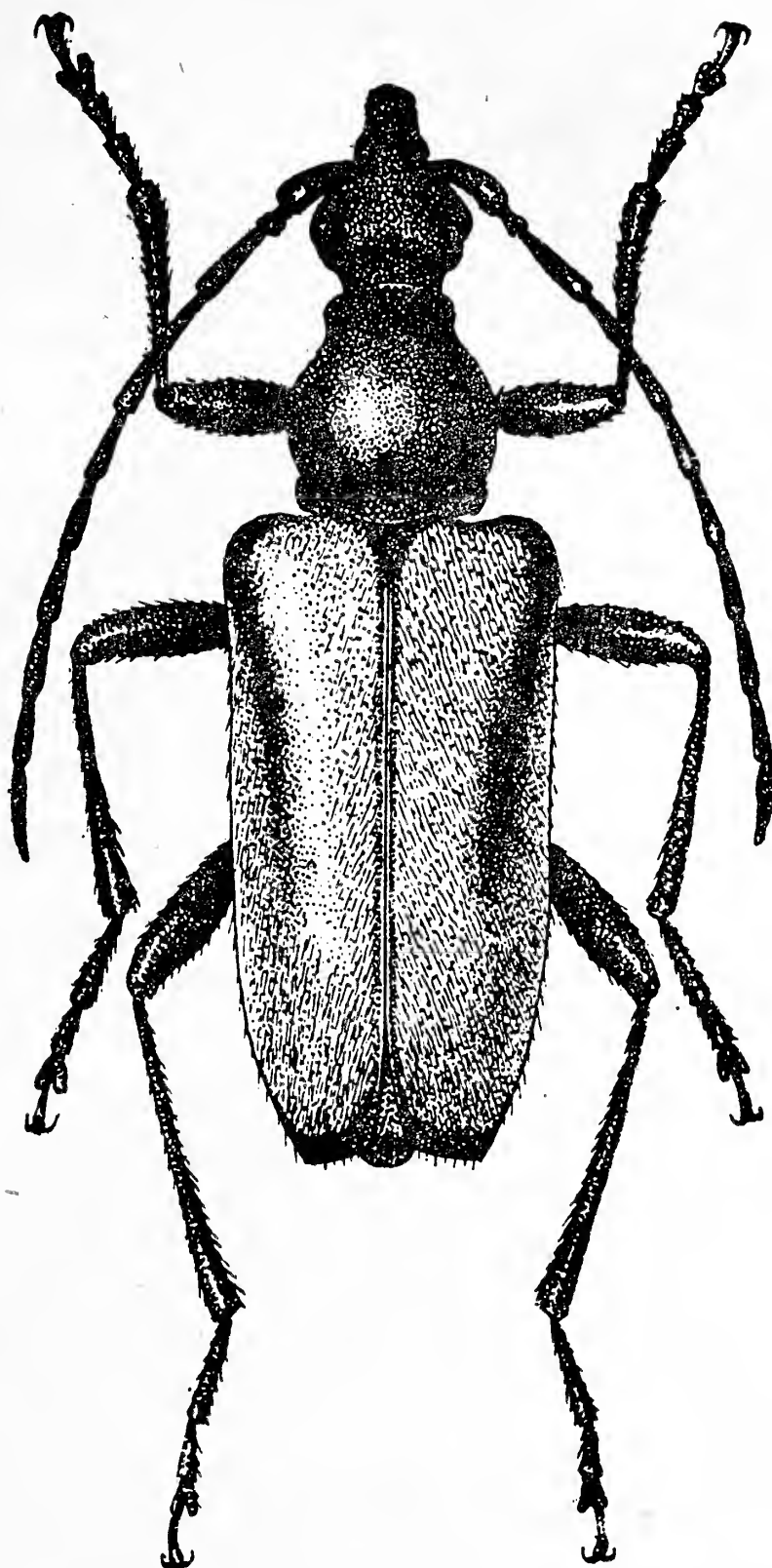
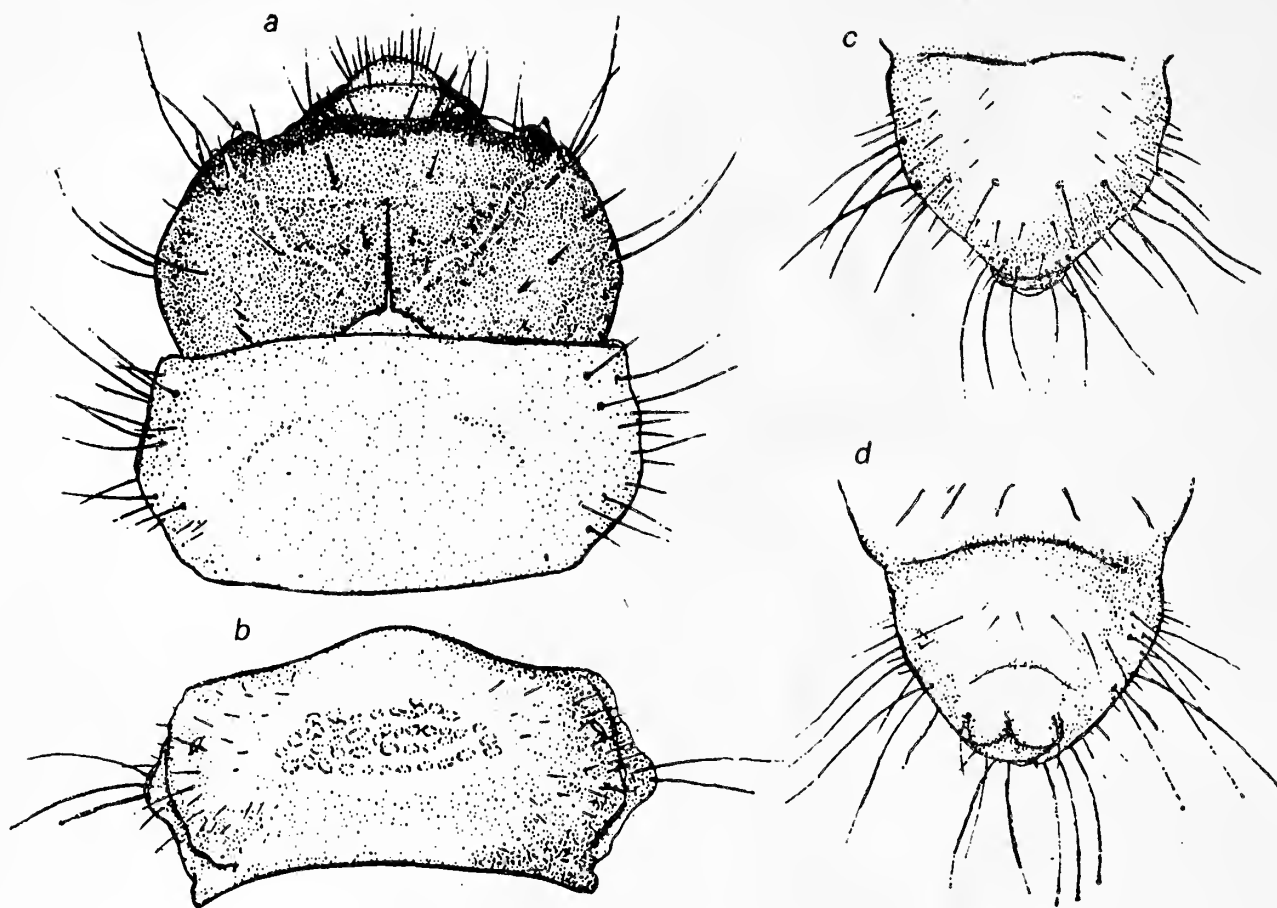


Figure 81. *Acmaeops pratensis* (Laich.).

times major part of elytra blackened (ab. *obscuripennis* Pic) or entire elytra straw-yellow (ab. *suturalis* Muls.). Length of body 7.0 to 10.0 mm.

162 *Egg*: Silvery-white, elongate, rounded at poles, narrows gradually toward one end, with dense cellular sculpture. Length 1.5 mm, width 0.5 mm.

Larva (Figure 82): Readily distinguished from larvae of other species by number of ocelli and form of epistoma. Body elongate. Head



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Figure 82. Larva of *Acmaeops pratensis* (Laich.).

a—head and pronotum; b—abdominal tergite with locomotory ampulla; c—tip of abdomen (dorsal view); d—abdominal sternite IX.

rounded laterally, narrower and flat in front. Epistoma broadly rounded apically, narrows markedly in posterior half. Here frontal sutures markedly flexed from inner parietal setae and transverse white band between them medially interrupted or barely perceptible. Longitudinal suture brownish-red, its anterior tip reaching beyond transverse band. Ocelli six ($3 + 2 + 1$), of which anterior ones identical in size and adjacent, but distinctly separated from one another; ocelli form short black band behind antennae.

Pronotum smooth and lustrous on disk, laterally with long setaceous hairs and almost 3.0 times wider than long. Legs long and slender, claws sharp and well sclerotized. Abdominal tergites slightly convex. Dorsal locomotory ampullae with small granules forming four indistinct rows; and laterally with one indistinct seta on each side. Tergite IX beyond middle with four large sclerotized, annular, setaceous pores forming transverse row, laterally and apically with long setaceous hairs and sparse minute setae. Abdominal sternite IX in posterior half with six to eight piliform setae forming transverse row; anteriorly sometimes with one or two small paramedial setae. Body white. Head reddish-rust, mandibles darker, almost black. Length of body up to 12 mm, width of head 1.8 mm.

Material: Collected in eastern Ural region, northern and central Ob' region, Altai, Yenisey taiga, Tuva, Baikal region, Yakutia, Trans-Baikal, along Kolyma River in Kamchatka, Ussuri-Primor'e region, and on Sakhalin. Adult insects about 1,000, larvae 11.

Distribution: In Eurasia from Atlantic to Pacific Ocean coasts and in North America. Universal in Siberia in coniferous forests. Found in large numbers in Altai around Lake Telets in Baikal region and in forests of the Kolyma River basin.

Biology: Inhabits coniferous forest zone, extending in mountains up to a height of 2,000 m above sea level. Reaches beyond Polar Circle in the north to boundaries of coniferous forests. Flight of beetles commences in first 10 days of June and ceases in August. Beetles maximum in July. Over a long period 855 beetles were collected in different regions of Siberia, of which 7.5% were found in June, 71.8%—July, and 20.7%—August. In mountains at a height of 2,000 m flight commences in early July and ceases mid-August. Beetles feed on flowers of Umbelliferae, Rosaceae, and other plants. During the feeding period gonads mature, beetles mate, and female lays eggs in bark crevices of felled and decaying coniferous trees, as well as those still standing (maple, elm, and others). One female can lay up to 32 eggs. Larvae hatch from eggs 12 to 20 days later, average 14 days. In one instance larvae began hatching from eggs laid on August 11 to 18 on September 5th, in another instance from eggs laid on July 27 to 30, on August 10. Larvae live under bark, make meandering galleries along shoot (trunk), plug them with fine fibrous frass consisting of bark, rarely of wood. Sometimes larval galleries imprinted on alburnum, their margins gentle and uneven. Length of gallery up to 8.0 cm or more, width up to 12 mm. Sometimes galleries have side branchings up to 1.0 cm long. Mature larvae bite oval openings and [fall through them to the soil for pupation. Generation evidently completed in two years.

2. *Acmaeops marginata* (F.)

Fabricius, 1781, *Species Insect.*, p. 247 (*Leptura*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 220–221; Gressitt, 1951, *Longicorn Beetles of China*, vol. 2, p. 68; Demelt, 1966, *Die Tierwelt Deutsch.*, p. 38; Kojima and Hayashi, 1969, *Insect Life in Japan*, vol. 1, p. 14.

Adult (Figure 83): Similar in general habits to *Acmaeops septentrionis* (Thoms.). Differs in light-colored tibiae and elytra notched at apex. Body comparatively elongate. Head with sparse minute punctation, transversely convex between antennae, and here with deep longitudinal suture. Antennal apices reach (male) or do not reach (female) middle of elytra.

Pronotum convex, markedly narrows anteriorly; with broad flange

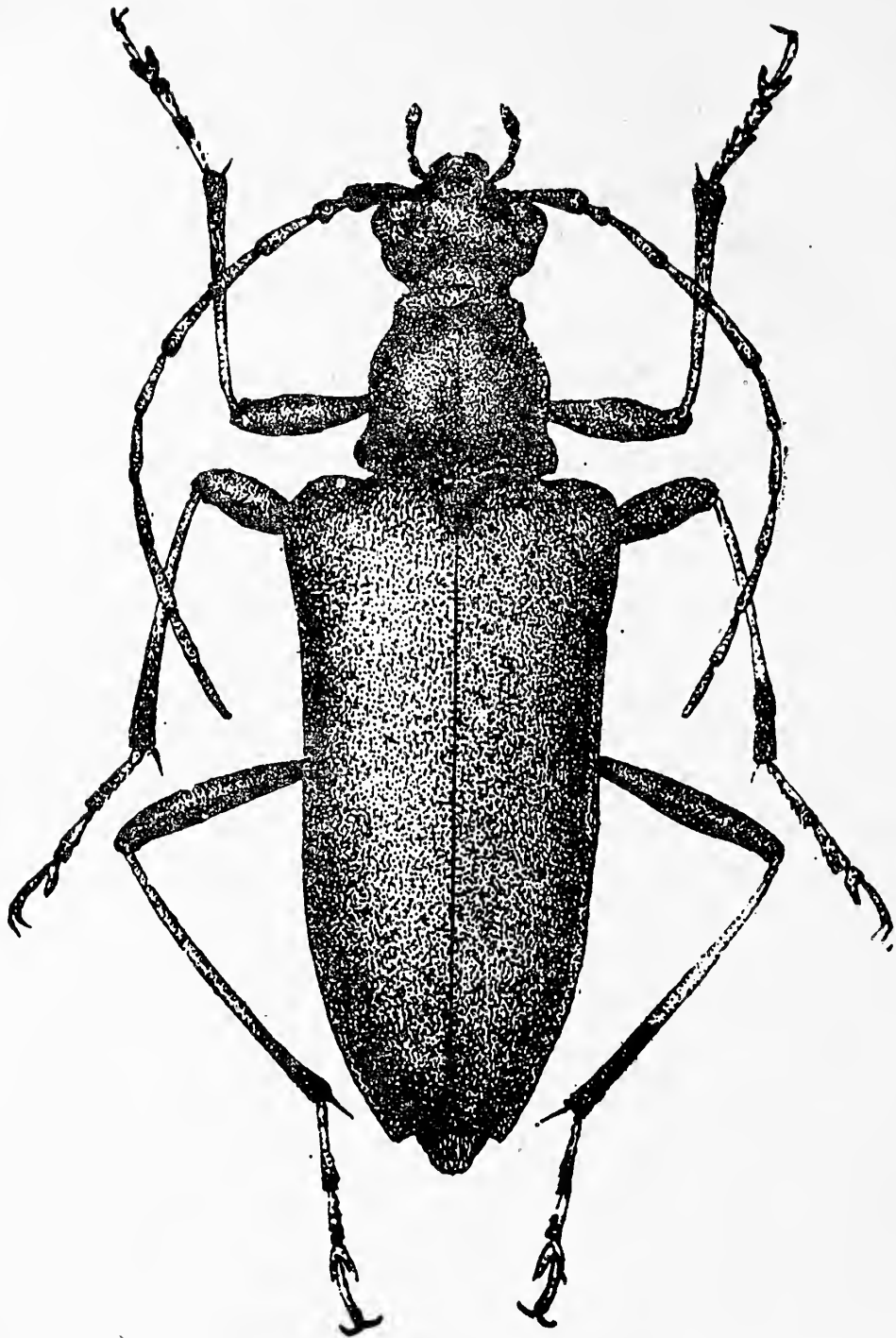


Figure 83. *Acmaeops marginata* (F.).

on anterior margin, narrow transverse depression on base, median longitudinal groove; with sparse punctation, spaces between punctures with fine dense sculpture, tender adherent and erect light-colored hairs. Scutellum triangular, pointed apically, with adherent hairs.

Elytra convex, slightly narrow apically, with dense even punctation and short adherent hairs; projecting rounded humeri, with longitudinal dent on inner side, notched apically, and with produced inner angles. Legs long and slender, hind tarsi shorter than tibiae. Body black: antennae rusty, sometimes darkened apically or uniformly blackish-brown, somewhat rusty only at apex. Elytra entirely straw-yellow or rarely black; sometimes with rusty or yellowish light-colored epipleura. Legs

black; tibiae light rust with blackened apices. Length of male and female 7.0 to 12.0 mm.

165 *Egg*: White, elongate, uniformly rounded at poles, with flat cellular sculpture. Cells penta- and hexagonal, spaces between them narrow, septate. Length 1.3 mm, width 0.5 mm.

Larva (Figure 84): Very similar to *Acmaeops pratensis* (Laich.). Readily distinguished from it by straight frontal sutures, and from other species by arrangement of setae on abdominal segment IX. Body moderately elongate. Head laterally rounded, gently narrows anteriorly. Epistoma subapically without constriction. Frontal sutures straight, only sometimes with slight flexure near inner parietal setae. Transverse white band between them continuous but near inner frontal setae with short white longitudinal streaks extending posteriorly. Longitudinal suture of epistoma extends anteriorly beyond transverse white band. Ocelli five ($2 + 2 + 1$). Lower ocellus of anterior pair much larger and upper comparatively small.

Pronotum on disk somewhat striate, laterally with uneven setaceous hairs forming three transverse rows—middle row and one row each at anterior and posterior margins. Thoracic legs slender, not particularly long, with thin sharp claws. Dorsal locomotory ampullae of abdomen somewhat convex, with four rows of granules, and stray short piliform

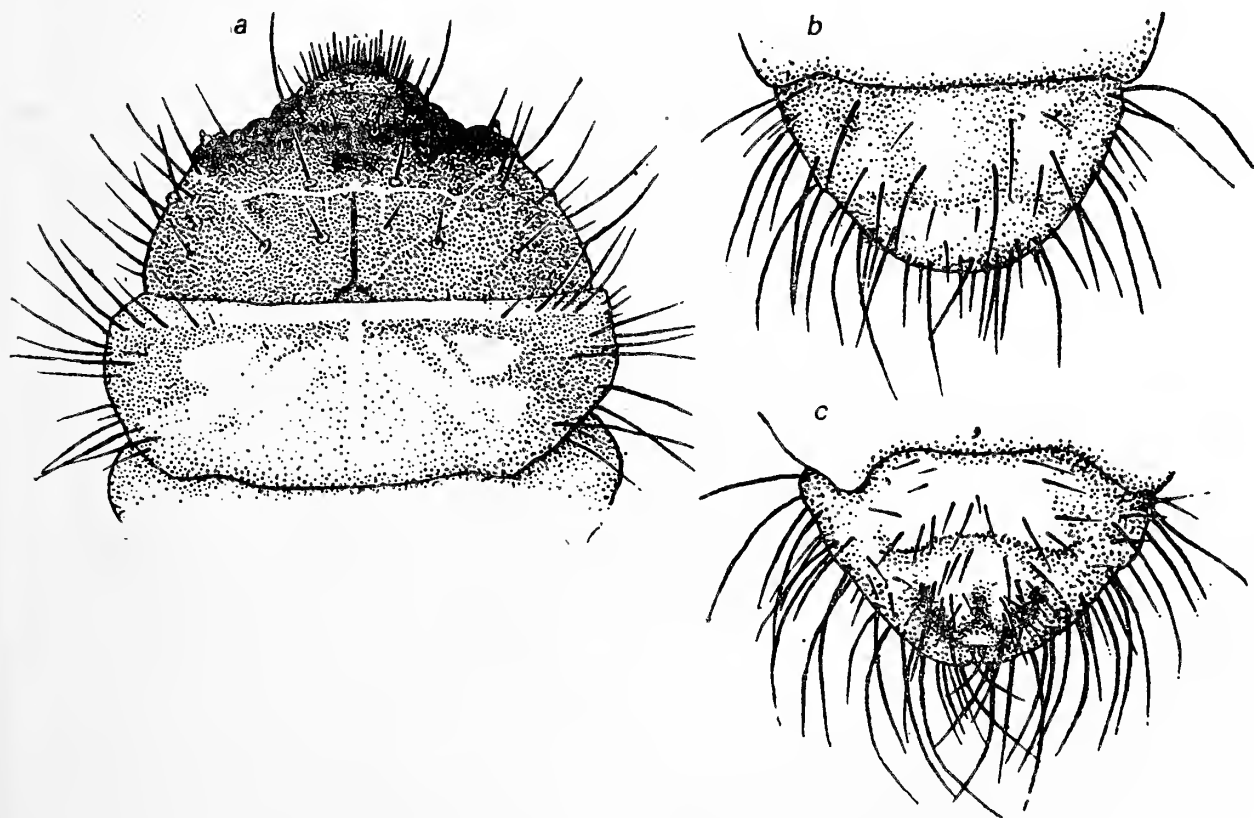


Figure 84. Larva of *Acmaeops marginata* (F.)
a—head and pronotum; b—abdominal tergite IX;
c—abdominal sternite IX.

setae laterally. Tergite IX beyond middle with four long piliform setae in transverse row; these setae thin, tender, with faint sclerotized ringlet at base; pair of short setae posteriorly on disk, stray setae anterolaterally, very coarse piliform setae apically, which sometimes form tufts. Abdominal sternite IX on posterior margin with eight to nine setae forming transverse row, on sides of disk anterior to middle with two to six setaceous hairs, of which outer ones much shorter and shifted forward due to projection of sternite. Sometimes these lateral hairs displaced forward or backward and widely separated or, contrarily, proximate in some specimens. Body white. Head reddish-rust. Mandibles blackish-brown. Anterior margin of pronotum with transverse yellowish band extending laterally. Length of body 16 mm, width of head 2.5 mm.

- 166 *Pupa* (Figure 85): Head markedly bent under; four setae each around base of antennae on inner side (one each in front and middle, and two behind), five to six setae on anterior margin of clypeus forming transverse row, and one tuft of thick setae behind each antenna.

Pronotum markedly narrows anteriorly, broadens angularly on sides, with broad flange on anterior margin, convex on disk, with thick acicular setae (up to 26) at base forming transverse row somewhat interrupted medially; thin long setae (up to 16) on anterior margin form transverse row; short thin setae (up to six) medially on anterior clivus; and long setae on each side forming tuft behind prominences. Mesonotum glabrous, without setae; metanotum with coarse thick setae forming two tufts.

Abdomen moderately elongate. Abdominal tergites posteriorly and laterally with thin striation and on disk with sparse uneven setae. Tip of abdomen sometimes slightly sclerotized, ventrally bound by horse-shoe-shaped carina set with thin dense hairs. Valvifers of female massive, contiguous, displaced laterally. Length of body 12 mm, width of abdomen 4.0 mm.

Material: Collected in eastern Ural region, Ob' region, Altai, Tuva, Kunashir. Adult insects more than 2,000 including 45 raised in the laboratory, larvae 138, pupae 21.

Distribution: Eurasia, from Atlantic to Pacific Ocean coasts. Comparatively frequently found in Altai around Lake Telets, in Tuva basin, south of Tomsk River basin, in eastern Ural region, and on Kunashir Island.

Biology: Ecologically associated with coniferous trees, mainly pine. Beetles seen early June and found almost up to mid-August. During systematic collection in western Siberia, of every 100 beetles 84 were collected in June, 14—July, and two—August. This is indicative of a mass flight in the first half of summer. However, in some years (1975, Lake Telets, Chiri) significant numbers of beetles were seen in mid-July.

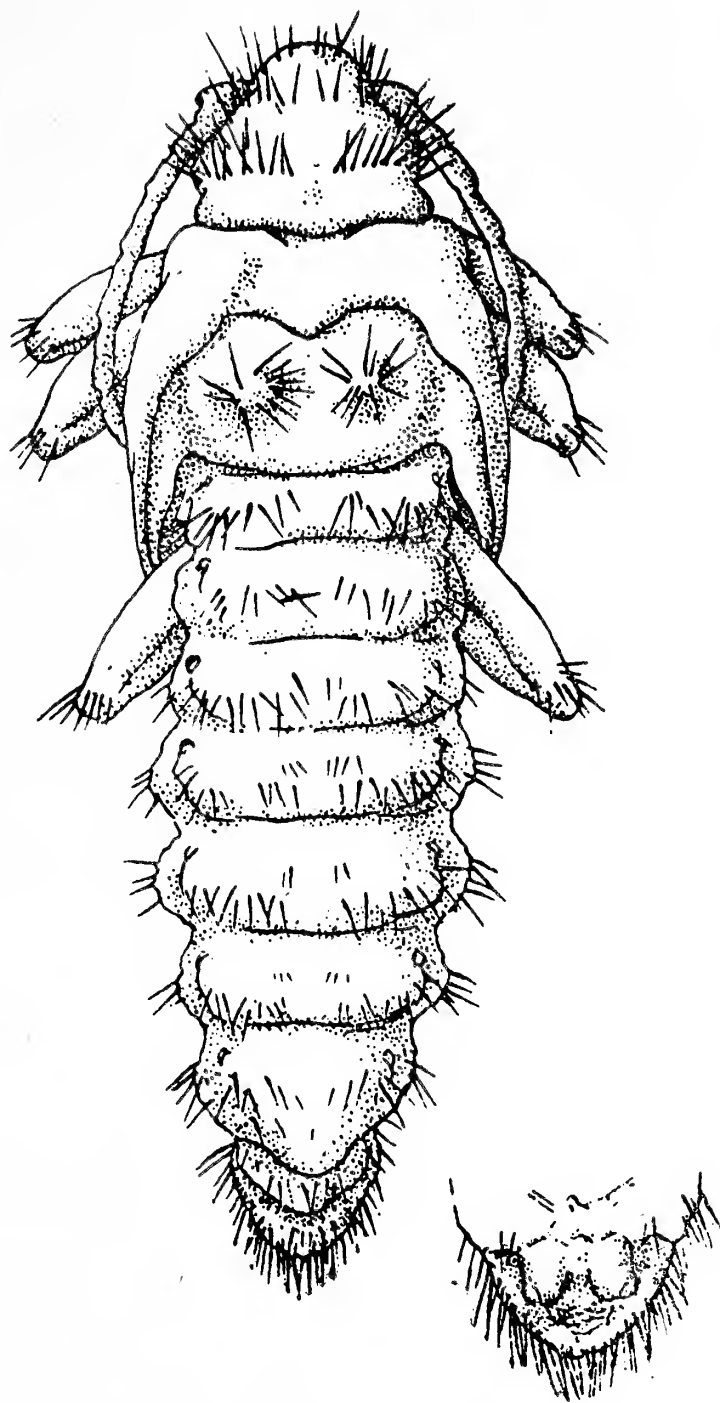


Figure 85. Pupa of *Acmaeops marginata* (F.), female.

Beetles additionally feed on flowers, gathering pollen from them. Ovaries of one female taken from flowers contained 48 mature eggs. As gonads mature beetles mate and female lays eggs singly in bark crevices on dead and wind-felled trees. Trunks and thick branches of
 167 pine (*Pinus sylvestris*) colonized, rarely other coniferous species, usually in thin bark zone. Larvae hatch from eggs after two to three weeks and immediately bore into bark.

Larvae make meandering irregular galleries under bark, slightly imprinted on alburnum, more often not, and plug them with bark frass. Sometimes larval galleries pass to bark surface as small openings filled with frass. Length of gallery 7.0 to 11.0 cm, width 20 to 30 mm. Quite

often larvae found on trunks under moist bark barely separated from alburnum. Third-instar larvae make oval exit at end of gallery, fall through it onto soil, burrow there, and make cell in which they pupate.

Pupation occurs in May. Pupae develop in 3.0 to 3.5 weeks. Emergence of young beetles from soil completed by June. Weight of larvae 29 to 90 mg, pupae 23 to 79 mg, and beetles 19.0 to 67.5 mg. Larvae falling from dry wood on moist soil gain weight by absorbing soil moisture. Thus weight of pupae quite often exceeds that of larvae entering soil for pupation. For example, one larva on entering soil weighed 42 mg (100%) and one month after remaining in soil before pupation weighed 48.5 mg (115.4%), pupa developed from it 46.5 mg (110.7%), and beetle emerging from pupa (female) 36.0 mg (85.7%). If the larva remains in soil for more than one month, its weight initially increases then drops gradually. Dynamics of the weight index are obvious in a series of weighings (Table 6). Females usually lose less weight during metamorphosis than males. Newly developed beetles remain in pupal cell for about one week. Total duration of life cycle two years.

Table 6. Weight variation in *Acmaeops marginata* (F.) during metamorphosis

Stage	Male			Female		
	No. of insects	Mean weight, mg	Weight, %	No. of insects	Mean weight, mg	Weight, %
Larvae entering soil	18	43.6 ± 2.6	100.0	20	58.6 ± 3.1	100.0
Larvae in soil before pupation	18	43.4 ± 2.1	99.5	20	60.2 ± 3.3	102.8
Pupae	18	41.6 ± 2.0	95.4	20	57.6 ± 2.6	98.3
Beetles seven days after development	18	32.7 ± 1.6	75.0	20	45.4 ± 2.2	77.5

3. *Acmaeops angusticollis* (Gebler)

Gebler, 1833, *Bull. Soc. Nat. Moscou*, vol. 6, p. 304 (*Pachyta*); *amurensis*, Suvorov, 1915, *Rus. entomol. obozr.*, 15, 3, 446; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 225-226; Gressitt, 1951, *Longicorn Beetles of China*, vol. 2, p. 68.

Adult (Figure 86): Proximate to *A. smaragdula* (F.) in green hair cover. Differs from it in absence of erect setaceous hairs on pronotum. Body slender, comparatively short. Head with large dense punctation and dense adherent hairs. Antennal apices reach beyond middle of elytra.

Pronotum somewhat longer than width at base, convex, with large

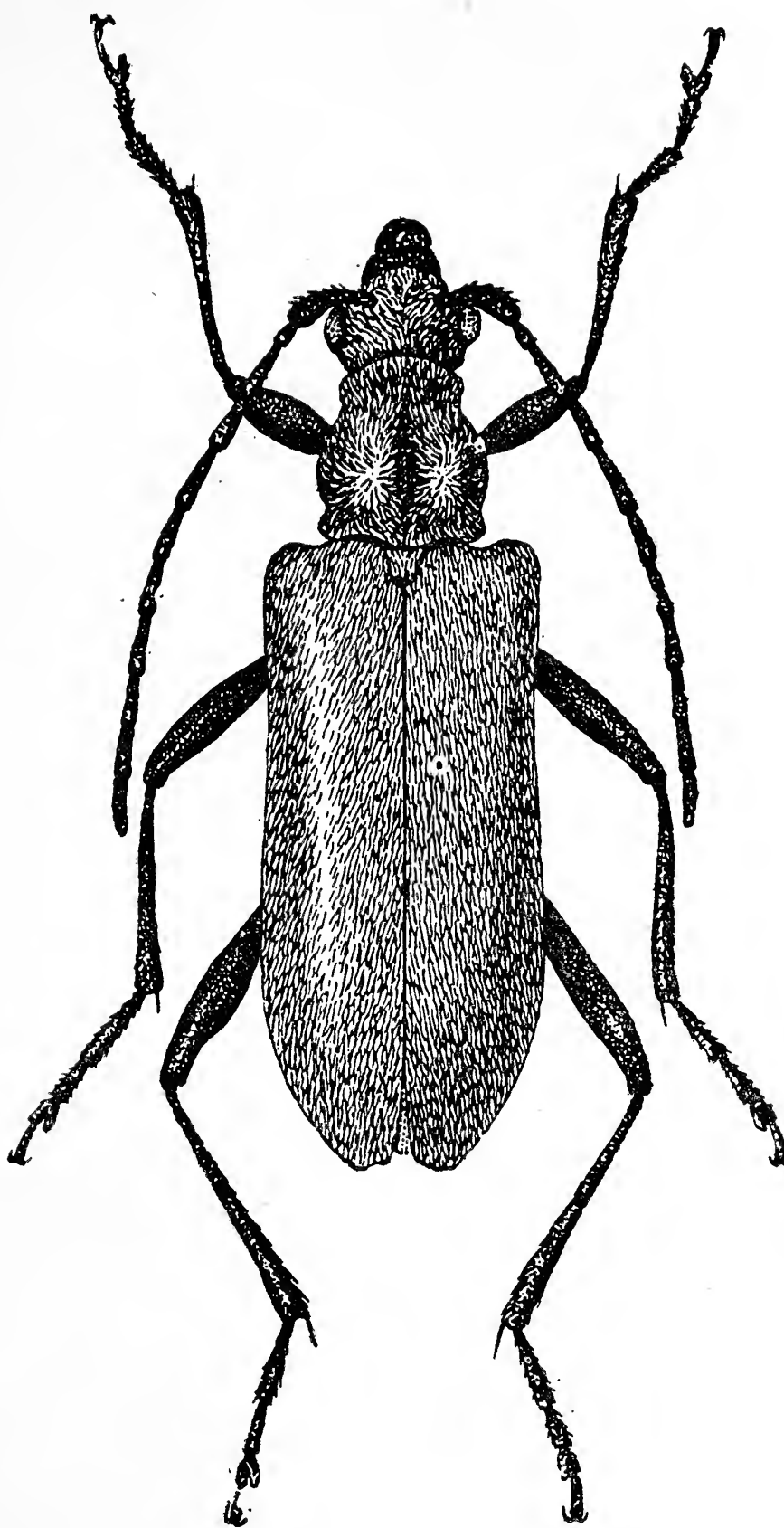


Figure 86. *Acmaeops angusticollis* (Gebler).

dense punctation, smooth median longitudinal groove, broad distinct flange at apex, less prominent flange at base; with dense adherent hairs directed toward apex of prominences (in posterior half) and here forming two tufts. Spaces between punctures shagreen. Scutellum triangular, usually with dense adherent hairs.

Elytra convex, with parallel sides, slightly obtuse apically, rounded gently on outer and narrowly on inner angles, with dense punctation and dense adherent hairs forming compact cover. Hind tarsi notably shorter than tibiae; 1st tarsal segment somewhat longer than two successive together. Body black; antennae dark brown, rusty at apex. Legs dark brown. Hair cover grass-green, rarely gray. Length of body 6.0 to 8.0 mm.

Egg: Silvery-white, rounded at both poles, with dense deep cellular punctation. Length 1.0 mm, width 0.4 mm.

Larva (Figure 87): Body moderately elongate, flat ventrally. Head somewhat retracted into prothorax, narrows more in front, rounded and flat laterally. Epistoma narrowly and angularly rounded posteriorly. Frontal sutures in posterior half somewhat curved, with nearly straight continuous transverse band between them. Longitudinal suture (sutura medialis) occurs on anterior margin of transverse band. Ocelli five ($2 + 2 + 1$), anterior two pigmented and located at antennal bases, posterior two black, widely separated specks shifted dorsally, and ventral unpigmented ampullar ocellus close to front pair. Lower ocellus of anterior pair larger than upper one. Hypostoma 2.0 times wider than long, with narrow white median longitudinal stripe. Clypeus large and smooth. Labrum wide and convex, with short setae in anterior half.

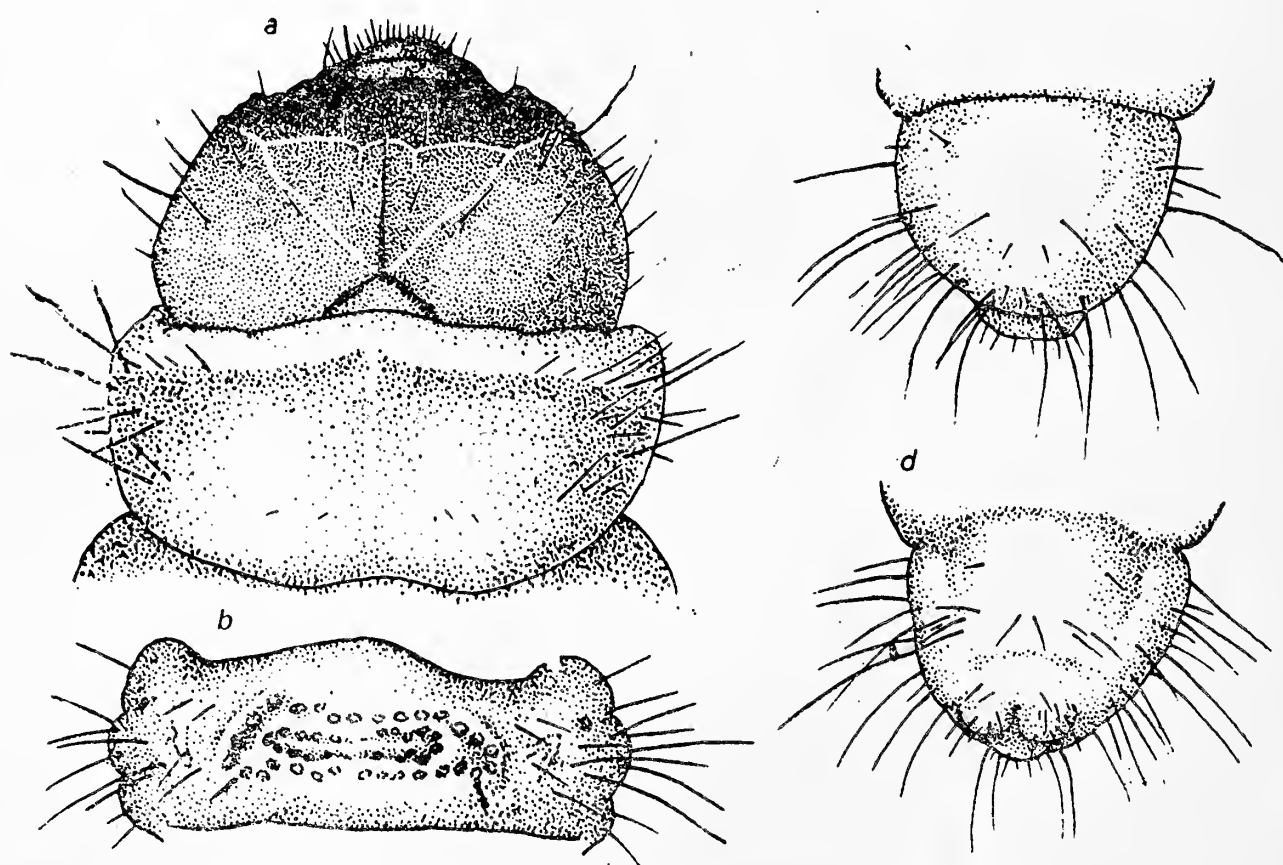


Figure 87. Larva of *Acmaeops angusticollis* (Gehl.).

a—head and pronotum; b—abdominal tergite with locomotory ampulla; c—abdominal tergite IX; d—abdominal sternite IX.

Mandibles elongate, obliquely truncate or notched apically, with produced lower denticle, on upper side medially with transverse band formed by this longitudinal striation.

169 Pronotum in length 0.33 width; long setaceous hairs laterally form three transverse rows; two minute indistinct and widely separated setae on disk—one in front of its center and one at base. Prosternum with stray setaceous hairs, of which six form transverse row in anterior half and four form two transverse rows on eusternum. Thoracic legs developed, with paired setae and long thin claws.

Abdomen flat, narrows toward apex, with long sparse hairs laterally. Dorsal locomotory ampullae slightly convex, with moderately large, sometimes indistinct granules forming four transverse rows. Between middle rows pair of widely separated short, sometimes barely perceptible setae occur. Targite IX not longer, or even shorter, than its width at base, on disk immediately behind middle with four setae forming transverse row, and long thick hairs along margins. Sternite IX in posterior half usually with eight long setaceous hairs forming transverse row, glabrous laterally in anterior half, with only one, rarely two short setaceous hairs. Ventral locomotory ampullae with two rows of granules. Length of body up to 8.0 to 14.0 mm, width of head up to 1.9 mm.

Pupa (Figure 88): Distinguished by long apical spinule on abdomen. Head markedly bent under; frons flat, four setae along margins of antennal base; temples with tuft of setae, of which one or two thick and coarse, remainder thin and piliform. Inner side of upper margin of each eye with one long seta. Antennae in second half annular.

Pronotum anteriorly with broad deep flange; anterior margin raised, with coarse setae; disk convex; five to six setae posterior to flange, thicker setae basally on papilliform base form transverse row intercepted by narrow clearance in middle, with usually 11 setae on each side of clearance. Mesonotum glabrous or with indistinct setae. Metanotum with two tufts of long setae.

170 Abdomen markedly narrows posteriorly. Abdominal tergites convex; posterior margin with sparse tender piliform setae, disk medially with stray setae directed toward midline. Tip of abdomen (ventral view) obtuse, bound by horseshoe-shaped carina set with numerous long thin setae, with long thin terminal spinule slightly sclerotized at tip. Valvifers of female large and thick, moderately separated, taper apically from inner side. Length 7.0 to 9.0 mm.

Material: Collected in Altai, Tuva, and Trans-Baikal. Adult insects 328, including 72 raised in the laboratory, larvae 85, pupae 17, larval exuviae with beetles from cells six.

Distribution: Siberia from the Urals to Pacific Ocean coast: northern

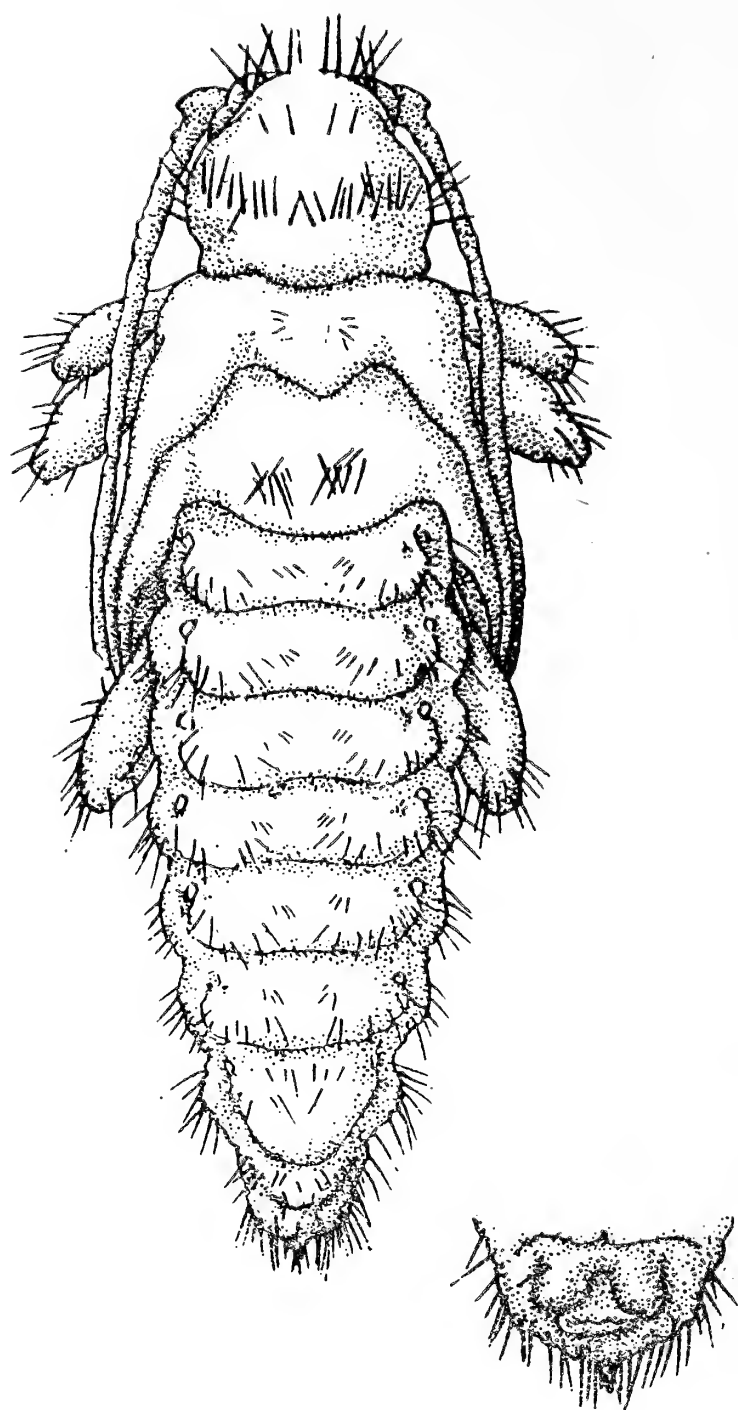


Figure 88. Pupa of *Acmaeops angusticollis* (Gebler.), female.

Mongolia, northern China, and North Korea. Found in large numbers in mountain forest belt of Altai.

Biology: Inhabits mainly mountain-taiga forest belt. Extends in mountains up to 1,000 m or more. Flight of beetles commences in middle 10 days of June and continues up to August. In Altai (Lake Telets region) of every 100 beetles collected, 29 were found in June, 70—July, and one—August. Beetles feed on flowers of Umbelliferae and other plants. Their gonads mature during feeding. In females raised in the laboratory 48 mature eggs were found in the ovaries after 12 weeks of supplementary feeding with honey syrup. Female lays eggs in bark crevices on trunk and branches of decaying and freshly fallen trees. Mainly

Siberian stone pine (*Pinus sibirica*) colonized. Larvae hatch 15 to 20 days after oviposition, average 18 days.

Larvae immediately after hatching bore into bark. Under bark they make longitudinal meandering galleries, barely imprinted on alburnum, and seal them with fine fibrous frass consisting of bark and often wood. Width of gallery 4.0 to 10.0 mm. Quite often gallery flat, like a platform, up to 2.0 cm wide and 5.0 cm long. Before pupation larva narrows gallery at end to 6.0 mm, makes cell along shoot, deepening it into wood, lays large bed of fibrous frass along sides, and pupates. Length of pupal cell 14 mm, width 7.0 mm.

Pupa develops in about three weeks. Newly developed beetle cuts circular opening on bark surface after five to seven days and emerges. Emergence of beetles from pupal cell commences mid-June and ends in first half of July. Weight of larvae 16 to 43 mg, pupae 13.2 to 38.0 mg, 171 beetles 9.0 to 27.0 mg. Life cycle completed in two years.

En masse reproduction of this species observed in forest clearances heaped with wood shavings, in forests damaged by fire, and in forests containing wind-felled trees. Population density comparatively high. Sometimes eight to twelve larvae recovered from 10 dm² of bark surface.

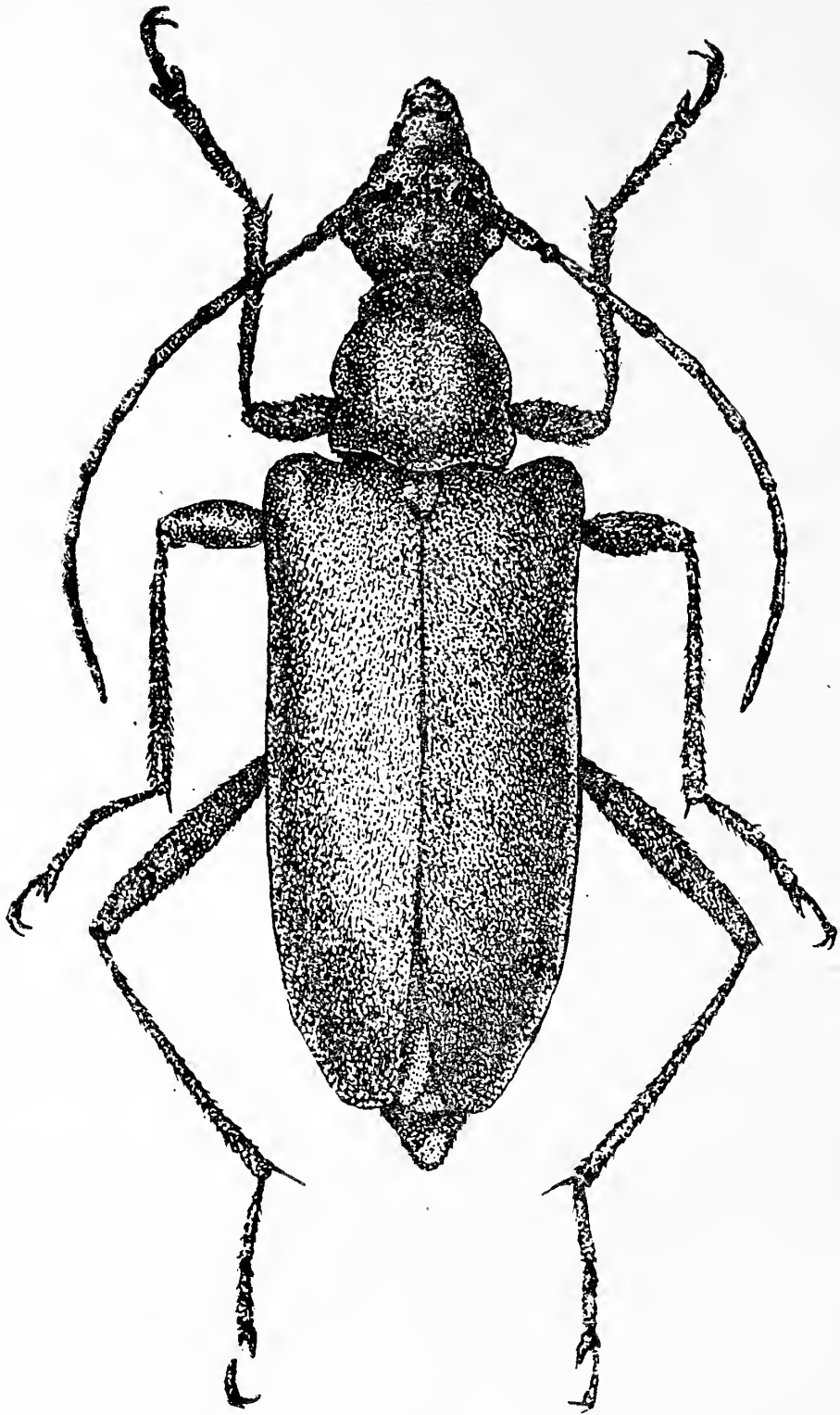
4. *Acmaeops septentrionis* (Thoms.)

Thomson, 1866, *Scand. Coleopt.*, vol. 8, p. 61 (*Pachyta*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 222–223; Gressit, 1951, *Longicorn Beetles of China*, vol. 2, p. 69; Demelt, 1966, *Die Tierwelt Deutsch.*, pp. 40–41.

Adult (Figure 89): Readily distinguished from proximate species [*Acmaeops marginata* (F.) and *A. smaragdula* (F.)] in monochromatic legs, rounded outer angle of elytral apex, sparse hair cover, and other features. Head with moderate, rather small punctation, transverse dent behind antennal bases between eyes, and sometimes with smooth median 172 longitudinal band. Antennal apices—11th segment (female) or 10th (male)—reach beyond middle of elytra.

Pronotum convex, with faint median longitudinal groove, anteriorly with deep flange (more prominent in male), and laterally rounded angularly; with rather sparse minute punctation, and sparse tender hairs that do not form continuous cover.

Elytra convex, with dense punctation forming transverse striation sometimes, and semiadherent light-colored hairs that do not form continuous tomentose cover; apically truncate, sometimes with sharply produced inner angles and invariably with obtuse rounded outer angles. Body black. Elytra black, with rusty light-colored border on epipleura (*f. typica*) or entirely straw-rust (*ab. simplonica* Stiel.), rarely entirely



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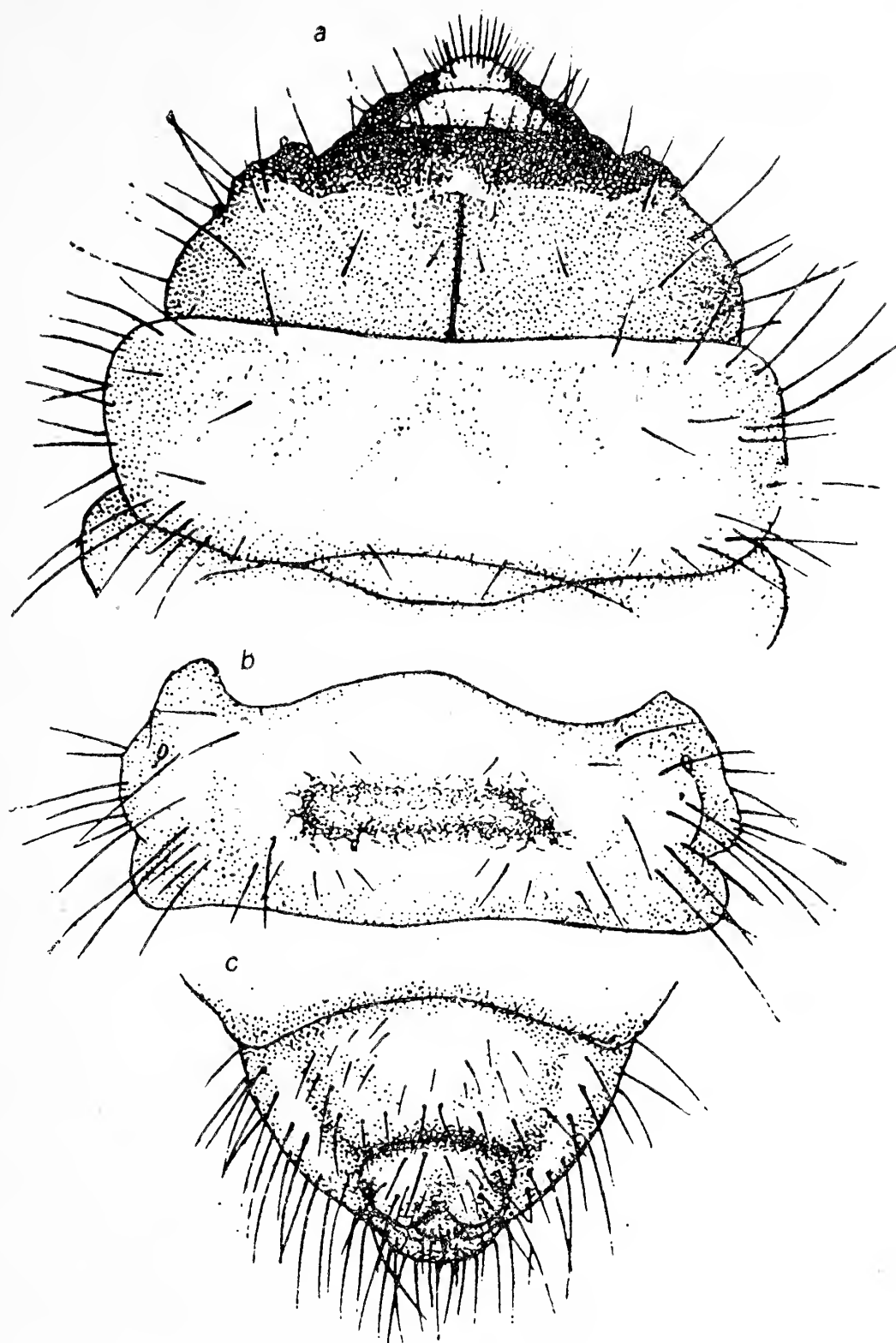
Figure 89. *Acmaeops septentrionis* (Thoms.).

black, without light-colored border (ab. *alpestris* Pic). Legs black. Antennae black, sometimes brownish-rust toward apex. Body length of male and female 8.0 to 11.0 mm.

Egg: White, longitudinal, smooth at one pole, narrowly rounded at the other, with flat cellular sculpture. Cells small, longitudinal, somewhat elongate, with narrow spaces between them. Length 1.4 mm, width 0.4 mm.

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Larva (Figure 90): Differs markedly in pubescence laterally and on abdominal segment IX. Body flat, moderately elongate. Head narrows



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Figure 90. Larva of *Acmaeops septentrionis* (Thoms.).

a—head and pronotum; b—abdominal tergite with locomotory ampulla;
c—abdominal sternite IX.

anteriorly, somewhat rounded laterally in posterior half. Epistoma narrows rather sharply in posterior third, away from inner parietal setae. Frontal sutures notably flexed here. Transverse white band between them continuous, posteriorly with two longitudinal short streaks extending from inner frontal (epistomal) setae. Longitudinal suture (sutura medialis) extends anteriorly from transverse white band. Ocelli

five ($2 + 2 + 1$) of which anterior ones sometimes fuse into continuous elongate spot.

Pronotum flat, with striation diverging posteriorly from anterior margin and forming narrow brownish bands. Laterally on anterior margin with four piliform setae forming distinct transverse row; lateral setae in middle and on posterior margin form two faint transverse rows. Thoracic legs short, claws somewhat sclerotized.

Abdomen broad, narrows only at tip. Abdominal tergites slightly convex; laterally between spiracles and locomotory ampullae with long setaceous hairs. Dorsal locomotory ampullae rounded laterally, divided by two transverse grooves, and with fine granules forming four transverse rows. Abdominal tergite IX transverse, with long setaceous hairs, of which four in posterior half much larger and form transverse row; usually smooth medially. Abdominal sternite IX almost entirely covered with sparse setaceous hairs, lacking only medially on anterior margin. Segment X and anal lobes with dense projecting hairs and hence abdominal tip appears densely pubescent ventrally. Body white; head reddish-rust. Pronotum rusty in anterior half and laterally. Length of body up to 15 mm, width of head 2.3 mm.

Pupa (Figure 91): Body moderately elongate. Head between antennae somewhat transversely convex; antennal bases with three setae on inner side forming longitudinal row, of which one much larger on lower margin and two proximate near upper, one on each side. Clypeus basally with five to six setae forming distinct transverse row in female, less distinct in male. Lateral setae on head behind antennae from comparatively dense tuft in female, scanty tuft in male.

Pronotum bulges, notably narrows anteriorly, with insignificant flange in anterior third, smooth on disk, sometimes with pair of widely separated setae; coarse acicular setae at base form transverse row that arches backward and is medially interrupted; long thin setae on anterior margin set on papilliform base form dense transverse row; thick setae laterally in posterior half in male, thin setae in female. Mesonotum with stray, barely perceptible setae. Metanotum in male with coarse, in female very thin setae forming two tufts.

Abdomen produced, gradually narrows posteriorly, with faint non-sclerotized terminal tubercle. Abdominal tergites on posterior margin with thin sparse piliform setae. Tip of abdomen bound by carina densely covered with tender piliform setae. Valvifers of female moderately separated, apically produced into lateral papilliform process. Length of body up to 12 mm, width of abdomen 3.0 mm.

Material: Collected in eastern Ural region, Ob' region, Altai, Tuva, Yenisey taiga, Trans-Baikal, Yakutia, Kolyma, Ussuri-Primor'e region, and Sakhalin Island. Adult insects over 300 including 35 raised in the laboratory, larvae 133, pupae 15.

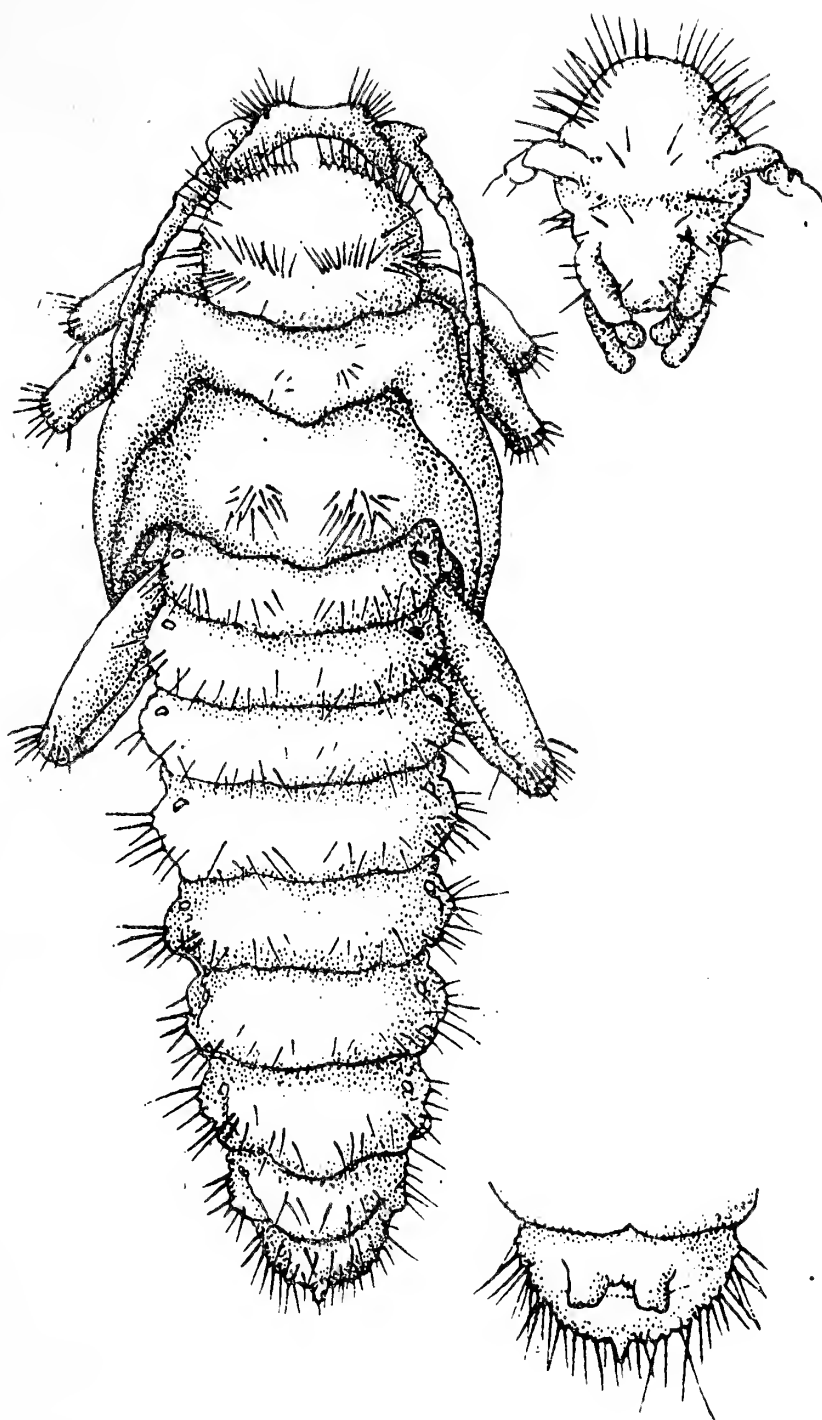


Figure 91. Pupa of *Acmaeops septentrionis* (Thoms.), female.

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Distribution: From Atlantic to Pacific Ocean coasts. All of Siberia, Far East islands; Mongolia, northern China. Found in large numbers in Altai, eastern Ural region, and southern Baikal region.

Biology: Inhabits coniferous forests, drawn toward mountain forest belt and extends in mountains up to 2,000 m. Flight of beetles commences in first 10 days of June and ceases by middle 10 days of August. During systematic collections in different regions of Siberia, of 234 beetles collected 41.9% were found in June, 50.8%—July, and 7.3%—August. Beetles sighted in hills at a height of 2,000 m in first few days of July and disappear by mid-August. They frequent flowers of Umbel-

liferae and other plants. After feeding they mate and lay eggs in bark crevices on maple, larch, and other plants. Trunks and branches of wind-felled trees such as maple, larch, pine, and others decaying at roots are colonized. One female can lay up to 22 or more eggs.

Larvae hatch from eggs in August and September, two weeks after oviposition. They bore into bark, penetrate inner bark layers and there make meandering galleries that change direction, and seal them with frass consisting mainly of bark. On removing bark, larval galleries seen deeply (sharply) imprinted on inner side and filled with frass. Galleries are perceptible on alburnum only in thin-barked branches. Width of gallery 6.0 to 18.0 mm, generally about 10.0 mm. Third-instar larvae nibble oval opening in August up to 4.0 mm wide and fall through it onto soil surface, where they burrow to depth of 3.0 to 5.0 cm, make a cell, and overwinter in it. Some larvae emerge after second hibernation.

Pupation occurs in cells in soil from May through June inclusive. Length of pupal cell 11 to 12 mm, width 7.0 mm. Only once did a larva in the laboratory pupate in a cell made under bark. This cell was lined with large fibrous frass. Such a phenomenon has not been seen in nature. In Khundurgun Pass (western Tannu-Ol' range) pupae were found up to mid-July. Soil temperature at this site of pupal development was 10 to 14°C. At room temperature pupae develop in three weeks, while at low temperatures development continues for 4.0 to 4.5 weeks.

Weight of III-instar larvae before pupation 22 to 55 mg, pupae 20.0 to 47.5 mg, and young beetles 15.5 to 39.5 mg. Life cycle completed in two years. Trunks up to 30 cm or more in diameter and branches up to 5.0 cm in diameter colonized. However, larvae were not found on trunks with decaying bark. They were generally seen under moist bark slightly separated from sapwood. *Acanthocinus carinulatus* Gebl., *Rhagium inquisitor* (L.), *Clytus arietoides* Reitt., and others are found together with this species.

5. *Acmaeops smaragdula* (F.)

Fabricius, 1792, *Syst. Entom.*, 1, 2, 342 (*Leptura*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 223-224; Gressitt, 1951, *Longicorn Beetles of China*, vol. 2, p. 69.

Adult (Figure 92): Readily distinguished from *Acmaeops angusticollis* (Gebl.) by erect hair cover on pronotum giving appearance of dense pubescence. Head with dense large deep punctation. Antennae short, with apices barely reaching beyond middle of elytra (male) or not reaching this level (female).

Pronotum markedly convex, with sharp flange on anterior margin,

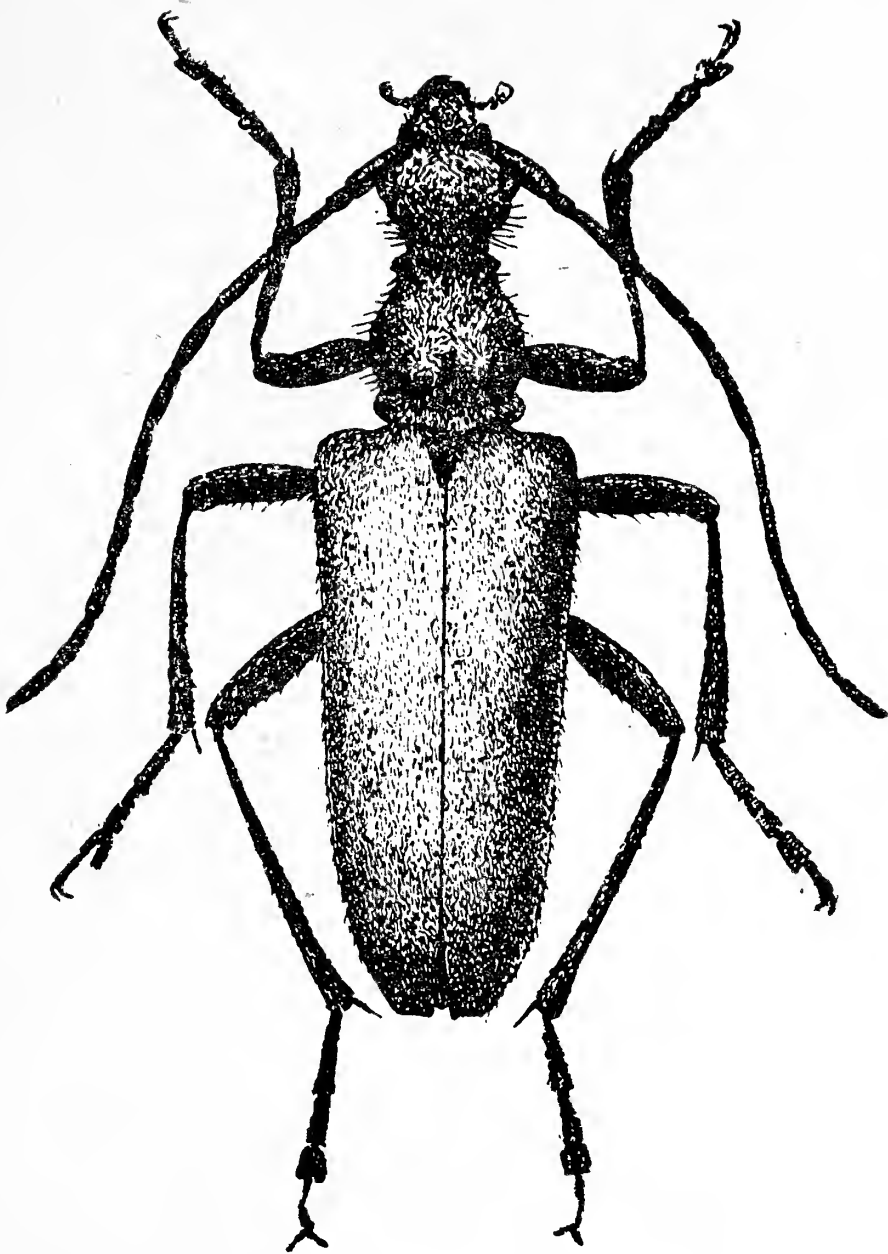


Figure 92. *Acmaeops smaragdula* (F.).

double emargination on posterior margin, and deep transverse groove at base; with more or less dense, deep, sometimes slightly obliterated punctation; often with smooth median longitudinal band; with adherent greenish or gray and long erect light-colored hairs (especially laterally).

- 176 Elytra narrow notably toward apex, convex, with rounded, somewhat projecting humeri, notched apically, with rounded outer angle; with dense even punctation, adherent greenish or gray hairs usually imparting green, rarely gray, tinge; hairs sometimes short, do not provide full cover. Body black; antennae apically sometimes brownish with rusty tinge. Length of body 7.0 to 11.0 mm.

Egg: Silvery-white, rounded at poles, narrows more toward one end, with fine cellular sculpture. Cells longitudinal, somewhat elongate. Length 1.2 mm, width 0.5 mm.

Larva (Figure 93): Highly similar to larva of *Acmaeops septentrionis* (Thoms.). Body flat. Head insignificantly narrows anteriorly. Epistoma pointed apically, somewhat compressed laterally in posterior half. Frontal sutures here insignificantly concave. Transverse white band between them continuous or with barely perceptible clearance at longitudinal suture (sutra medialis). Hypostoma narrows somewhat anteriorly, with narrow median longitudinal white band. Ocelli five (2+2+1), of which third one, forming anterior pair, much lighter in color. Clypeus broad and lustrous, narrows slightly anteriorly. Labrum transverse, gently rounded anteriorly, with short setae on anterior margin. Mandibles elongate, obliquely truncate apically.

Pronotum flat, finely rugose, lustrous; hairs on sides typical of this genus. Thoracic legs slender, claws thin, sclerotized, long, and recurved, sometimes falcate apically.

Abdomen with parallel sides, narrows posteriorly, with long setaceous hairs laterally. Dorsal locomotory ampullae broaden posteriorly, transversely trapezoidal, slightly convex, divided by two transverse grooves, with fine granules forming four transverse rows; middle rows proximate, anterior and posterior ones joined laterally and form

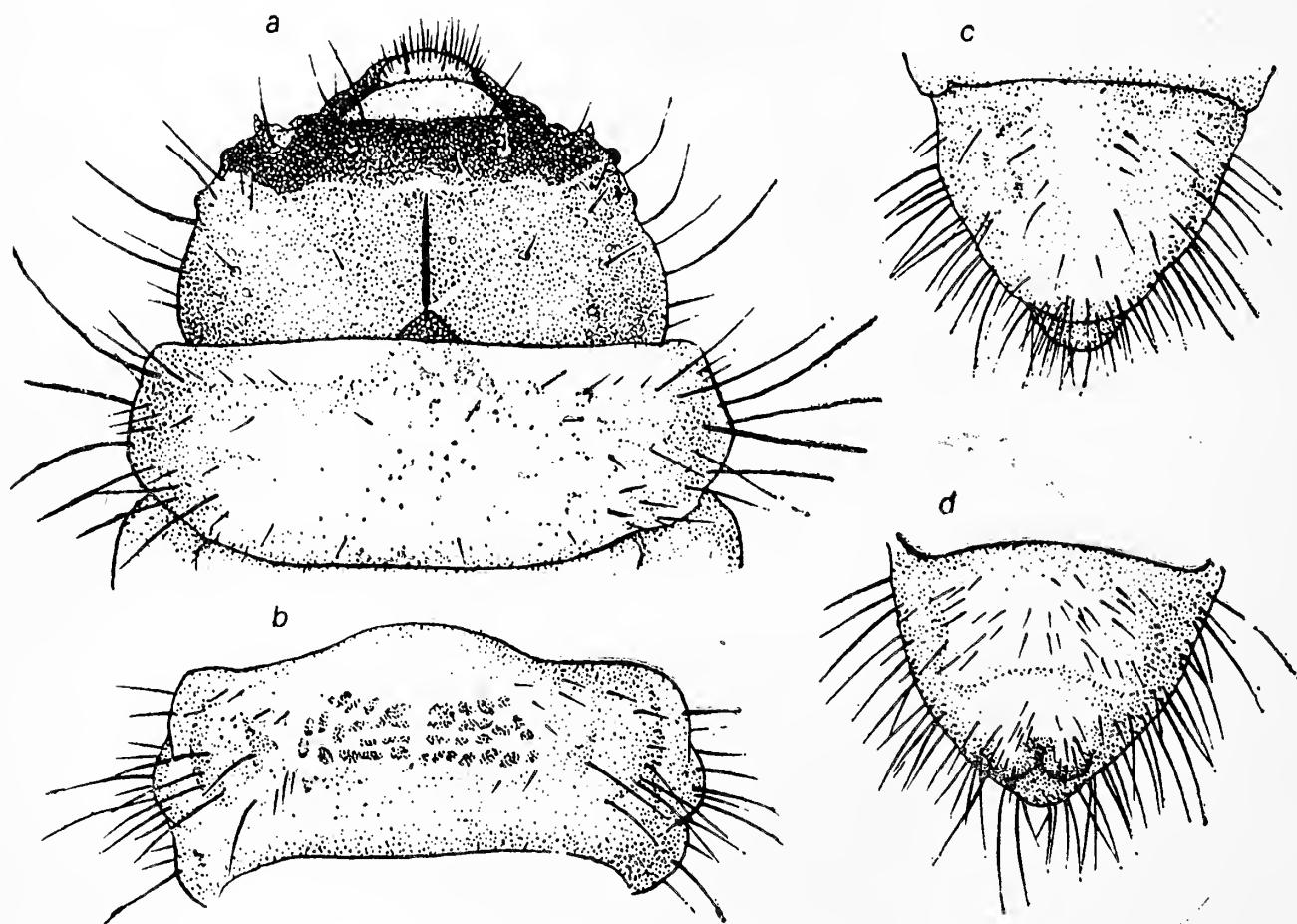


Figure 93. Larva of *Acmaeops smaragdula* (F.).

a—head and pronotum; b—abdominal tergite IV with locomotory ampulla;
c—abdominal tergite IX; d—abdominal sternite IX.

177 tetragon that narrows anteriorly (Figure 93, b). Lateral fold directed toward anterior angles. Abdominal tergite IX laterally with dense, on disk sparse coarse setaceous hairs—four beyond middle much larger and form transverse row. Abdominal sternite IX with dense setaceous hairs constituting more or less continuous field; sometimes posterior margin of sternite with eight very large setae forming isolated transverse row. Tip of abdomen laterally and at base of anal lobes with large setaceous hairs. Body white. Head reddish-rust, dark brown, almost black on anterior margin in region of epistoma. Length of body up to 14 mm, width of head 2.1 mm.

Pupa (Figure 94): Differs from *Acmaeops septentrionis* (Thoms.) in more elongate tubercular nonsclerotized spine on tip of abdomen, and

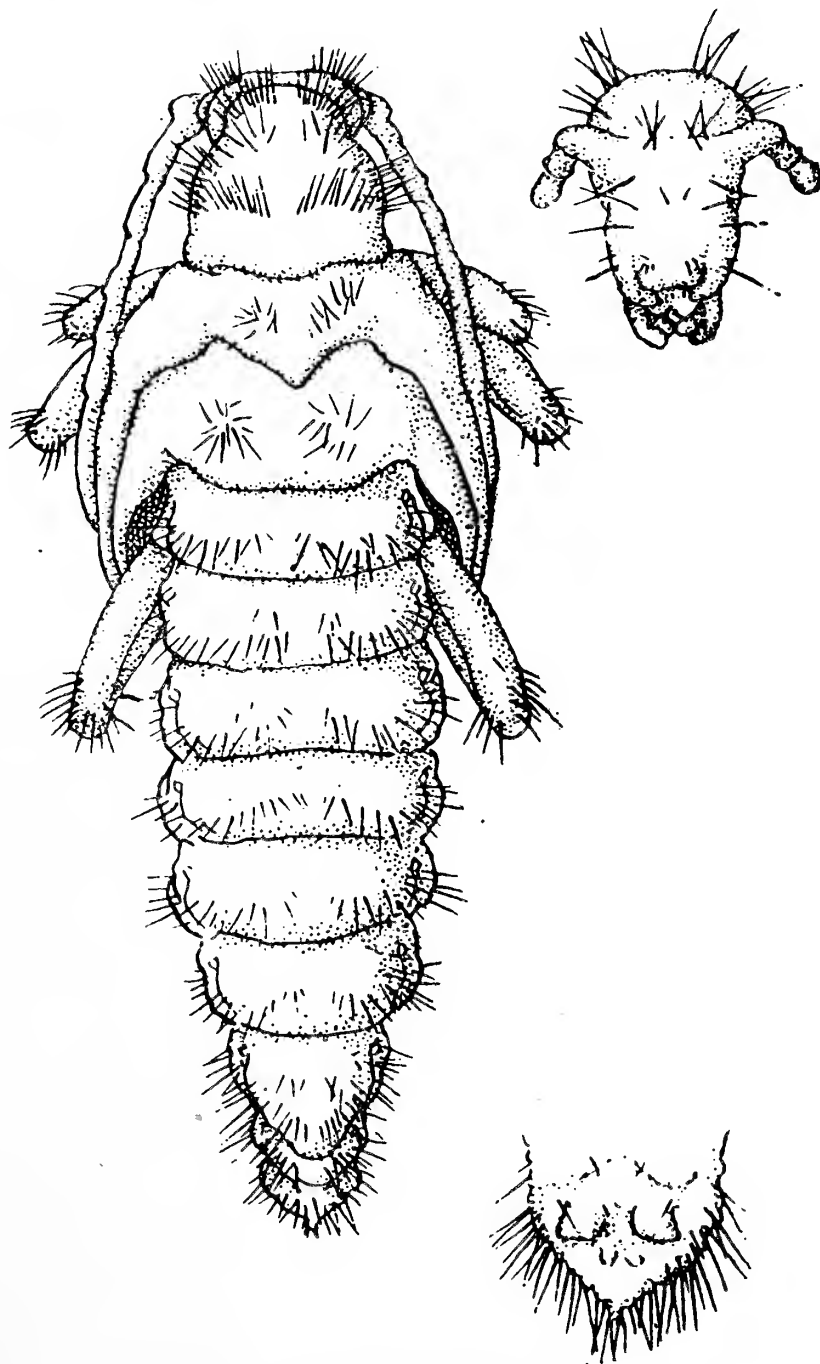


Figure 94. Pupa of *Acmaeops smaragdula* (F.), female.

arrangement of setae mediolaterally on pronotum. Body comparatively elongate. Head bent under; three setae at base of antennae on inner side, upper setae proximate; pair of minute setae between antennae in middle; three pairs of setae form transverse row on anterior margin of clypeus; one seta behind each antenna close to eyes; and five setae forming lateral tuft on each side of occiput.

Pronotum markedly convex in posterior half, narrows in anterior half, with distinct flange; anterior margin with acicular setae on papilli-form base forming dense transverse row interrupted medially, similar but somewhat coarser setae on posterior margin forming transverse, slightly concave or almost straight row interrupted medially [in *Acmaeops septentrionis* (Thoms.) this row distinctly replicate]. Anterior clivus with two short, laterally four long setae forming common transverse band. Mesonotum with distinct fine setae forming two tufts; metanotum with very coarse setae forming two tufts.

Abdomen elongate, narrows posteriorly. Abdominal tergites convex, with short tender piliform setae on posterior margin. Tip of abdomen produced, spinescent, bound ventrally by horseshoe-shaped carina densely set with tender piliform setae. Valvifers of female large, contiguous, and somewhat laterally produced at apex. Length up to 12 mm.

Material: Collected in eastern Primor'e, Ob' region, Altai, Tuva, Yenisey forests, Trans-Baikal, and Kolyma. Adult insects 611, including 21 raised in the laboratory, larvae 78, pupae 14.

Distribution: Colonizes coniferous forest zone of Eurasia. Common in Siberia from the Urals to Pacific Ocean coast. Found in large numbers in mountain forest belt of Altai-Sayan region, eastern Ural region, and forests of Kolyma River basin.

Biology: Inhabits cedar, cedar-fir, spruce, larch, and pine belts. Ecologically associated with coniferous wood species. Extends in mountains up to forest boundaries. Flight of beetles usually commences in middle 10 days of June and extends up to first few days of September. Beetles found in large numbers in second half of July. Of 573 beetles collected throughout the season over several years, 38 were found in June, 300—July, 234—August, and one—September. Beetles require supplementary feeding; often seen on flowers gathering pollen from them, rarely feeding on petals. Gonads mature during feeding period. In a female raised in the laboratory and dissected 12 days after supplementary feeding, 22 mature eggs were found in the ovaries. After mating female lays eggs in bark crevices of cedar, fir and other coniferous species. Eggs are laid on trunks and shoots and evident from second half of June almost up to mid-September. Larvae hatch from eggs 12 to 22 days after oviposition (average 16 days).

Larvae live under bark, make irregular meandering galleries, resem-

bling platforms at places. Galleries plugged with frass consisting of bark and deeply impressed on inner side of bark. Length of gallery up to 10 cm, width 6.0 to 20.0 mm. At end of gallery mature larva nibbles oval opening and falls through it onto soil, burrows to a depth of 3.0 to 5.0 cm, makes a cell, and pupates in it. Emergence of larvae from trees commences in August and ends in May of the following year. Hence some larvae spend the second winter in their galleries under bark, while others do so in pupal cells in soil.

Pupation commences in May and ceases in June. Maximum pupae recorded in second half of June and early July. Emergence of beetles from pupae commences from first 10 days of June to mid-July. Weight of larvae before pupation 26.0 to 61.6 mg, pupae 23.4 to 53.5 mg, and young beetles 19.9 to 44.4 mg. Weight reduction during metamorphosis in *Acmaeops smaragdula* (F.) and *A. septentrionis* (Thoms.) comparatively less manifest than in *A. angusticollis* (Gehl.) (Table 7). This is partly explained by the fact that the former two species pupate in soil where moisture is considerably higher than in wood. The third species
179 remains under bark for pupation. Life cycle completed in two years. *Acanthocinus carinulatus* Gehl. and *Acmaeops septentrionis* (Thoms.) develop with this species on the same trees.

6. *Acmaeops sachalinensis* Tsher.

Cherepanov, 1978, *Taksonomiya i ekologiya chlenistonogikh Sibiri* (Nov. i maloizv. vidy fauny Sibiri), pp. 99–100.

Adult (Figure 95): Body moderately elongate. Head with large dense punctation; faint longitudinal suture medially between antennae; narrows
180 gently behind eyes; with yellowish adherent hairs. Eyes markedly convex, yellow, finely faceted, without emargination on inner side. Antennae set in front of eyes, barely extend beyond middle of elytra, with short dense hairs, and apically matte commencing from 6th or 7th segment. Third antennal segment not longer, or only slightly longer than 4th, equal to 5th.

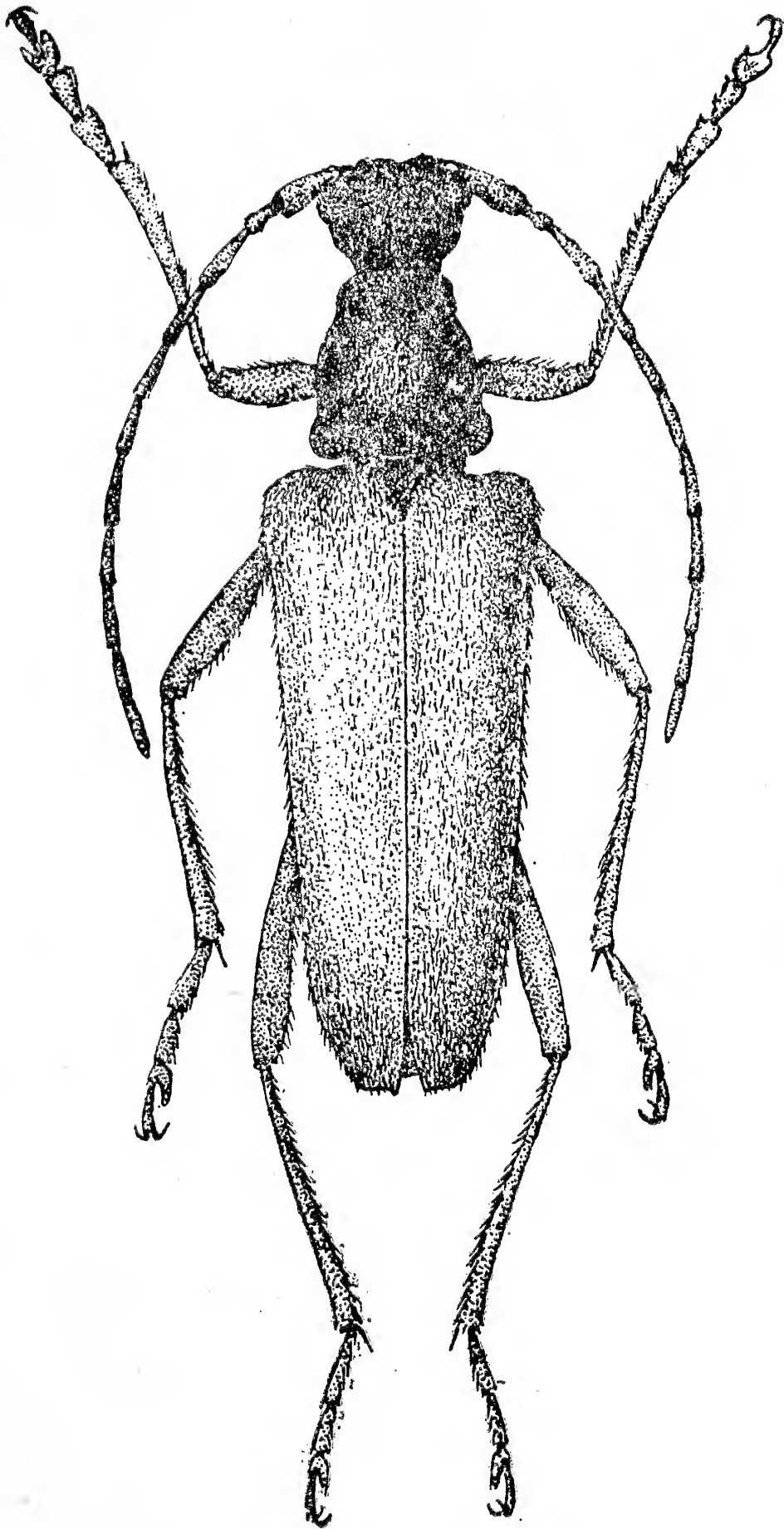
Pronotum elongate, more so in male; insignificantly narrows anteriorly broadly rounded laterally, with broad flange in anterior third; bulges on disk and medially without longitudinal groove; with large dense punctation and yellow (golden) adherent hairs. In addition to these hairs, female with very distinct erect hairs on sides of pronotum. Scutellum triangular, more or less pointed apically, with moderate punctation and light-colored adherent hairs. Legs comparatively long; hind femora barely reach elytral apices. Hind tarsi distinctly shorter than tibiae; 1st tarsal segment 2.0 times longer than 2nd, 3rd bifurcate almost up to base.

Elytra elongate, bulge moderately, narrow toward apex, apically truncate with straight inner and rounded outer angles; with fine dense

Table 7. Weight variation during metamorphosis in species of the genus *Acmaeops* (M ± m)

Species	Larva				Pupa				Adult	
	No. of insects	Mean weight, mg	%	No. of insects	Mean weight, mg	%	No. of insects	Mean weight, mg	No. of insects	%
<i>A. angusticollis</i>	34	27.8 ± 1.5	100	34	22.8 ± 1.1	82.8	34	16.6 ± 0.9	34	59.7
<i>A. septentrionis</i>	22	37.5 ± 1.9	100	22	33.9 ± 1.6	90.4	22	26.6 ± 1.5	22	70.9
<i>A. smaragdula</i>	13	39.8 ± 3.3	100	13	35.8 ± 2.9	89.9	13	30.0 ± 2.5	13	75.3

Note: Weights in percentage refer to mean weights of larvae before pupation.



punctuation and dense yellowish hairs. Apex of abdominal sternite V (female) emarginate. Body ventrally with dense yellowish hair cover. Body ventrally, scutellum, elytra, antennae, legs, and mouthparts rusty. Head and pronotum dark brown. Length of body 7.0 to 10.0 mm.

Material: Holotype—male: Sakhalin, Nikol'skii Bay, April 17, 1909 (Nikol'skii). Paratype—female: Sakhalin, April 17, 1909 (Nikol'skii).

7. *Acmaeops minuta* (Gebler)

Gebler, 1832, *Nouv. Mem. Soc. Nat. Moscou*, vol. 2, p. 69 (*Pachyta*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 228–229; Gressitt, 1951, *Longicorn Beetles of China*, vol. 2, p. 69; Kojima and Hayashi, 1969, *Insect Life in Japan, Longicorn Beetles*, vol. 1, p. 13.

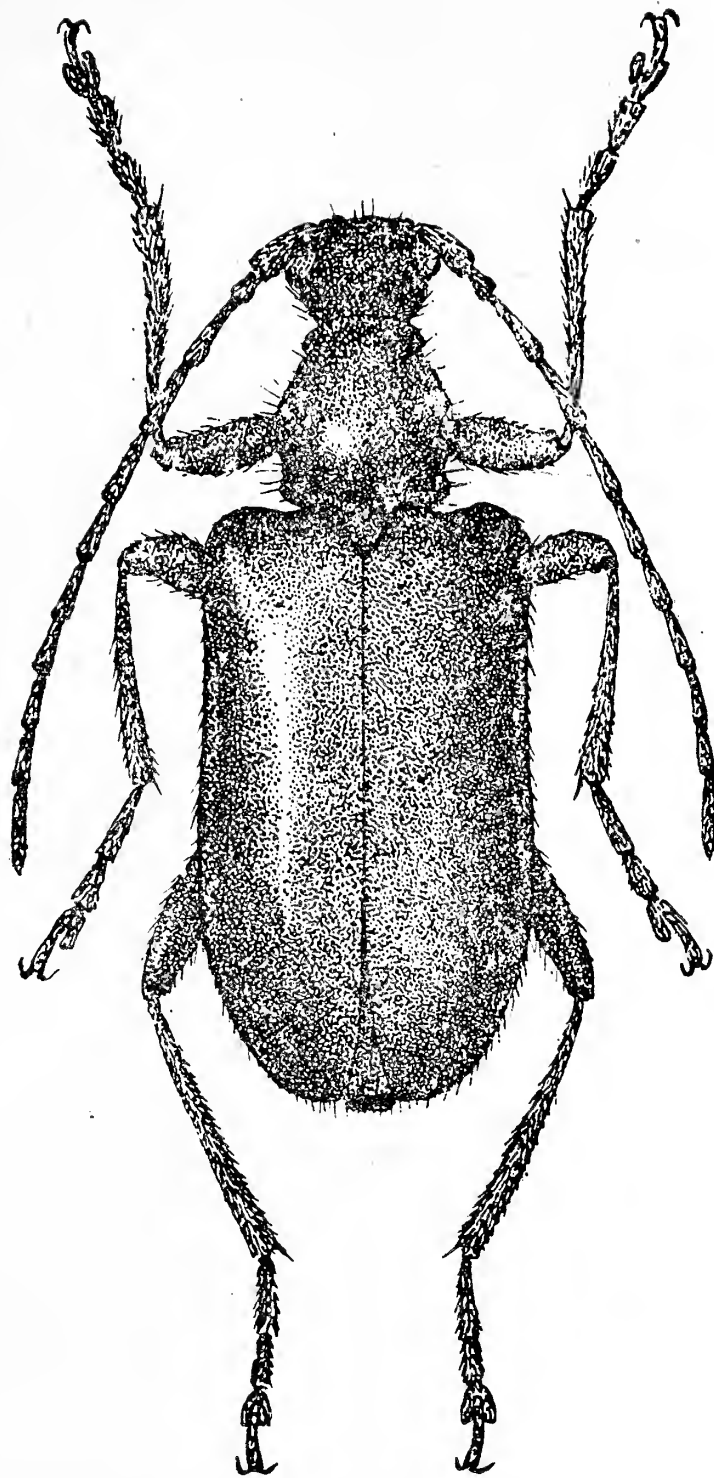
Adult (Figure 96): Differs from the proximate species *Acmaeops anthracina* (Mannh.) in bluish elytra with metallic sheen. Head with large, rather sparse punctuation, with narrow median longitudinal suture, tubercular protuberance at base of antennae on inner side, narrows gently behind eyes; spaces between punctures with very fine sculpture. Apices of antennae reach beyond 0.50 (female) and 0.66 (male) length of elytra.

Pronotum with bulging disk, markedly narrows anteriorly, without sharp flange on anterior margin, with finely edged base, and roundly produced posteromedially; with sparse, comparatively large punctuation and fine erect light-colored hairs not forming continuous cover. Scutellum markedly narrows toward apex, more elongate in male; markedly broadens at base, triangular, with large dense punctuation in female. Hind tibiae distinctly longer than tarsi; 3rd tarsal segment small and bifurcate almost up to base.

Elytra convex, with parallel sides, lateral margin curved behind humeri, and gently rounded apically; large punctuation in anterior half of disk form transverse striation; minute obliterated punctuation and short, partly adherent hairs laterally and in posterior half. Body black; elytra metallic blue; antennae and legs dark brown; tarsi often with rusty tone. Length of body 6.0 to 9.0 mm.

Egg: White, narrows toward poles, narrowly rounded at ends, and with fine cellular sculpture. Cells longitudinally elongate. Length 1.0 mm, width 0.4 mm.

Larva (Figure 97): Body flat. Head in posterior half broadly rounded, narrows gradually toward front and steeply so toward base. Posterior half of epistoma narrows into projection, broadly rounded at apex. Frontal sutures and transverse white band anterior to middle distinct. Longitudinal suture cinnamon-brown, extends anteriorly up to transverse white band. Ocelli six (3 + 2 + 1); anterior ones fuse into transverse black band, posterior ones widely separated, and lower one light colored, sometimes barely perceptible. Hypostoma narrows somewhat and flat anteriorly, with white median longitudinal band.

Figure 96. *Acmaeops minuta* (Gebler).

Pronotum 3.0 times wider than long, flat, sometimes with distinct striation; sparse coarse thick setaceous hairs laterally form transverse row on anterior and posterior margins. Prosternum smooth, presternum with large seta at each anterior angle. Legs slender, comparatively long; claws short, somewhat curved, reddish-brown.

Abdominal tergites slightly convex, with four coarse thick lateral setae; of these, one in front of spiracle, pair of very large setae behind spiracle, and one adjacent to posterior angle of locomotory ampulla. Dorsal locomotory ampullae with granules forming transverse rows.

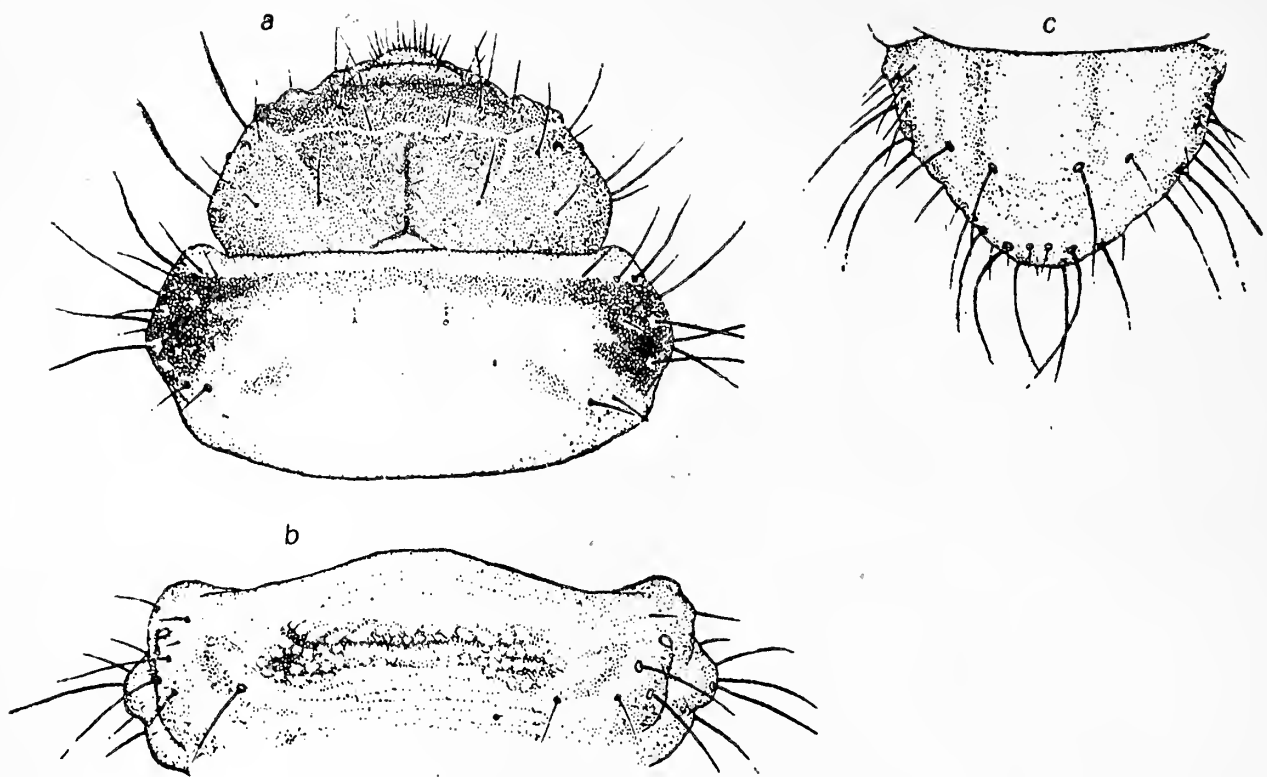


Figure 97. Larva of *Acmaeops minuta* (Gehl.).

a—head and pronotum; b—abdominal tergite IV with locomotory ampulla; c—abdominal tergite IX.

- 182 Abdominal tergite IX not wider or only slightly wider at base than long, with four coarse piliform setae emerging from annular brownish sclerotized pores forming transverse row beyond middle, and coarse piliform setae laterally and apically. Abdominal sternite IX smooth, with seven to eight setae only on posterior margin forming transverse row. Anal lobes smooth. Two or three setae in transverse row on each side at base of ventral lobes. Body white. Head reddish-rust. Anterior margin of pronotum with rusty-yellow transverse band, laterally with large black sharp (sometimes indistinct) spot. Length of body up to 10 mm, width of head 1.8 mm.

Pupa (Figure 98): Readily distinguished from species of the subgenus *Acmaeops* s. str. by absence of flange in anterior half of pronotum. Body moderately elongate. Head markedly bent under; three setae at base of each antennae on inner side form two longitudinal rows; tuft of long setae on temples behind antennae; one or two minute setae, sometimes barely visible, laterally on anterior margin of frons. Antennae flexed to sides, with apices turned ventrad beyond midfemora.

Pronotum narrows gradually from base to apex, slopes uniformly forward on disk; anterior flange lacking; anterior margin medially smooth; five to seven lateral setae set on produced base, 12 to 14 widely separated setae form transverse row medially interrupted on posterior margin, and pair of minute widely separated setae on disk. Mesonotum

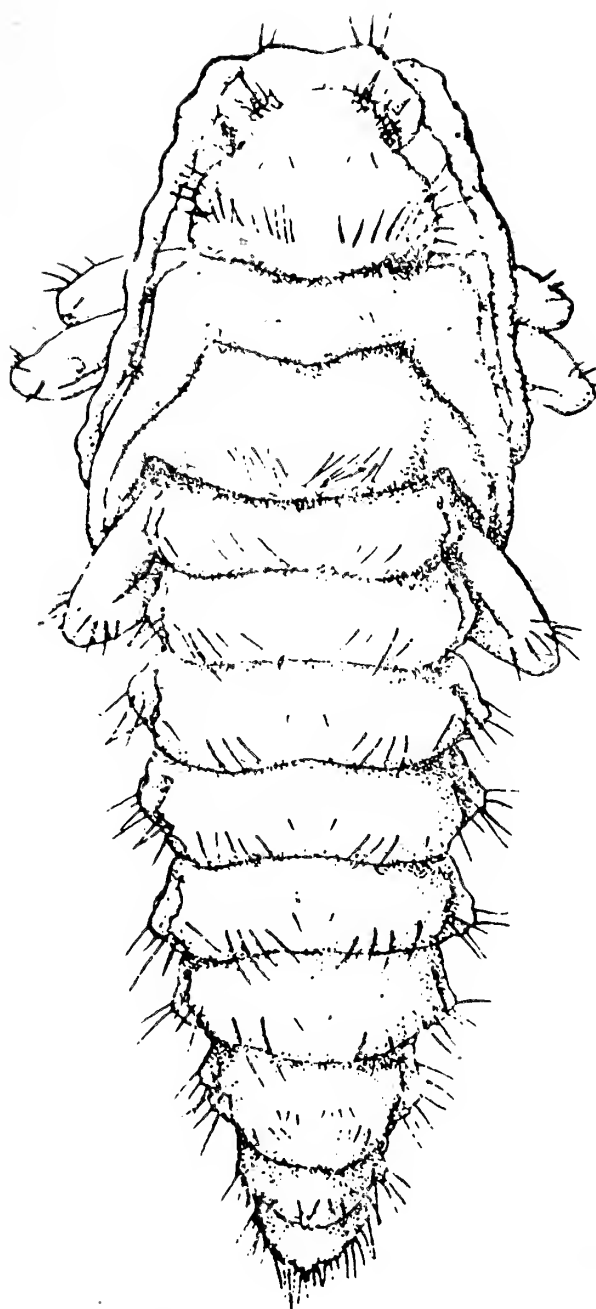


Figure 98. Pupa of *Acmaeops minuta* (Gobl.).

with three indistinct lateral setae. Metanotum with eight to nine long paramedial setae bent inward, forming two tufts.

Abdomen narrows gradually toward tip. Abdominal tergites convex; three to four long piliform setae laterally on posterior margin form transverse row. Tip of abdomen laterally with long light-colored setae and small nonsclerotized, sometimes indistinct terminal tubercle. Valvifers of female large, contiguous. Length of body 7.0 to 8.0 mm, width of abdomen 2.1 mm.

Material: Collected in Ussuri-Primor'e region (Komarovka and Artemovka Rivers). Adult insects 133, larvae 16, pupae two.

Distribution: Eastern Siberia from Shilka to Sakhalin; northern China, Korea, and Japan.

Biology: Inhabits deciduous forests. Ecologically associated with

maple (*Acer*), walnut (*Juglans*), ash (*Fraxinus*), and other deciduous wood species. Flight of beetles in June and July. In 1972 and 1979, during systematic collections along Komarovka River, of 122 beetles collected 22 were found in first 10 days of June, 84—second 10 days, 12—last 10 days, and four—July. Beetles disappear at end of July. Often feed on flowers and mate there. Female later flies to trees, oviposits under splitting bark scales or small depressions in bark. Colonizes decaying, recently dead, and wind-felled trees. Eggs quite often laid on trunks of decaying undergrowth up to 2.5 cm in diameter.

Larvae hatch from eggs in July and August. They make longitudinal meandering galleries in bark and plug them with frass, leaving outwardly only a thin film of cork layer. Galleries not impressed on alburnum. Larvae found in nature on Manchurian striped maple (*Acer tegmentosum*) and Manchurian ash (*Fraxinus mandschurica*). Mature larvae nibble oval opening on bark surface and fall through it onto soil, make pupal cell here at a depth of 3.0 to 6.0 cm, and pupate in it. Length of pupal cell 6.0 mm, width 5.0 mm.

Pupae mainly found in May and early June. Young beetles sighted end of May and in first half of June; they do not remain more than one week in cells. Beetles exit from cells from early June to second half of this month. Weight of larvae before pupation 8.6 to 47.0 mg, pupae 6.4 to 37.0 mg, and beetles 5.0 to 25.0 mg. Female usually much larger than male. Life cycle completed in two years. *Gaurotes ussuriensis* Bless., *G. kozhevnikovi* Plav., *Rhopaloscelis bifasciatus* Kr., and others sometimes found with this species on the same trees.

8. *Acmaeops anthracina* (Mannh.)

Mannerheim, 1849, *Bull. Soc. Nat. Moscou*, 22, 1, 246 (*Pachyta*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 229–230; Gressitt, 1951, *Longicorn Beetles of China*, vol. 2, p. 69.

Adult (Figure 99): Proximate to *Acmaeops minuta* (Gehl.). Differs in elytra oily-black, without metallic-blue sheen. Head with minute punctation, narrows uniformly behind eyes. Eyes large, markedly convex, temples comparatively short. Antennae thin, with apices extending beyond middle of elytra (male) or slightly short of reaching this level (female).

Pronotum convex, elongate, sometimes with sharp median groove; with minute punctation and erect light-colored hairs; narrows notably from middle toward anterior margin. Scutellum elongate, basally comparatively narrow, more or less rounded at apex, with dense punctation. Hind tibiae barely longer than hind tarsi.

Elytra convex, moderately elongate, with parallel sides; with dense punctation, large basally, minute apically; short semiadherent hairs,

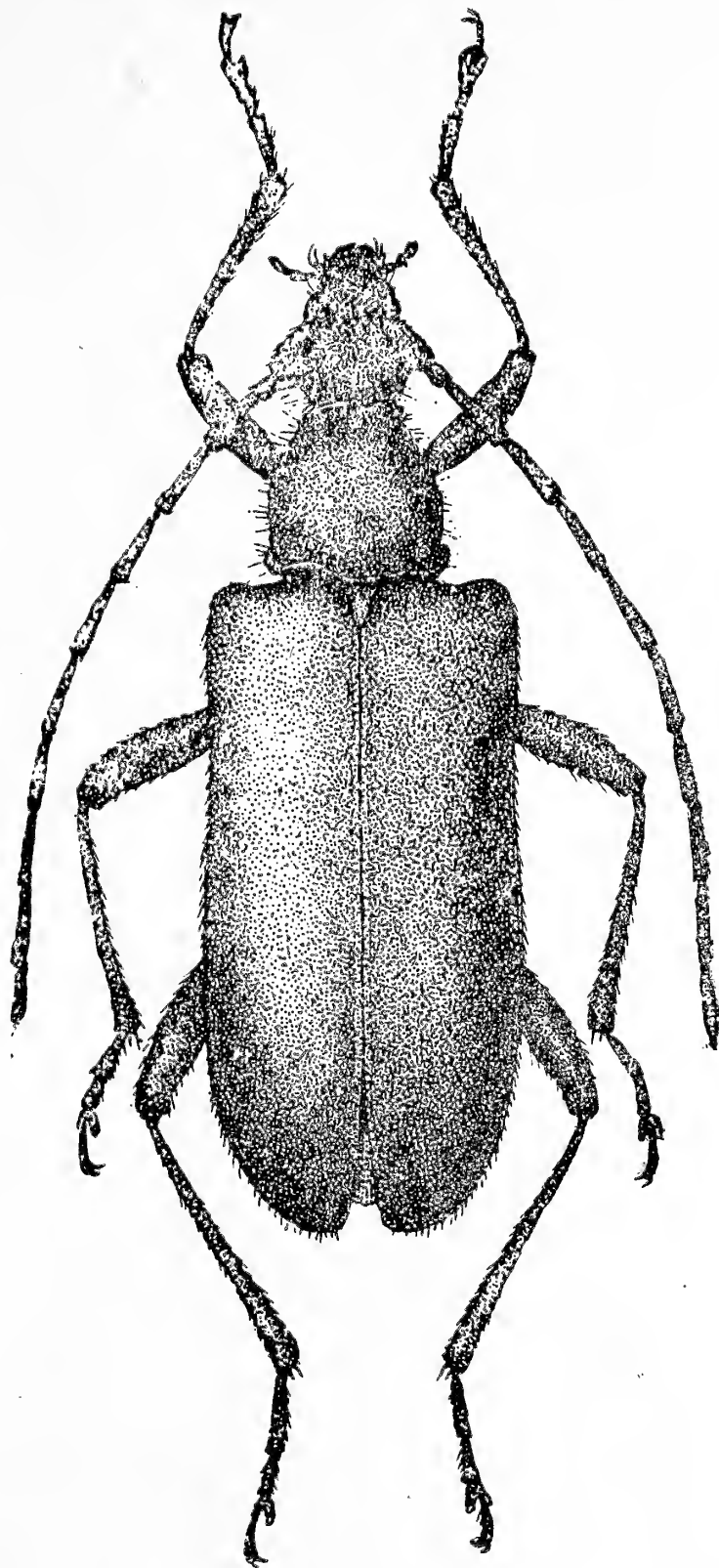


Figure 99. *Acmaeops anthracina* (Mannh.).

bent on sides; rounded together at apex. Body pitch-black. Elytra black, without metallic-blue sheen. Antennae dark brown, with rusty tinge. Length 6.0 to 8.0 mm.

Distribution: Southern Siberia, from Yenisey to Ussuri-Primor'e region; northern Mongolia, northeast China, and Korea.

Biology: Found sporadically. Inhabits deciduous trees. Beetles fly in June and July, feed on flowers. Material consists of two insects from Irkutsk.

9. *Acmaeops collaris* (L.)

Linnaeus, 1758, *Syst. Nat.*, 10th ed., p. 398 (*Leptura*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 227-228; Gressitt, 1951, *Longicorn Beetles of China*, vol. 2, p. 69; Demelt, 1966, *Die Tierwelt Deutsch. Cerambycidae*, vol. 2, p. 41; Duffy, 1953, *Monogr. Immat. Stages British and Imp. Timber Beetles*, pp. 118-120.

Adult (Figure 100): Readily distinguished from other species of the genus by red pronotum and red abdomen. Head with minute punctation, somewhat elongate, with longitudinal suture between antennae. Apices of antennae barely reach beyond middle of elytra; 6th to 8th segments matte.

Pronotum bulges, smooth, with sparse shallow punctation and erect hairs; flange lacking on anterior margin; narrows from middle toward apex, sides almost parallel in posterior half. Scutellum triangular, with sparse punctation, narrowly or gently rounded at apex.

Elytra bulge, smooth, with almost parallel sides, rounded individually at apex; moderately punctate and with semiadherent hairs. Hind

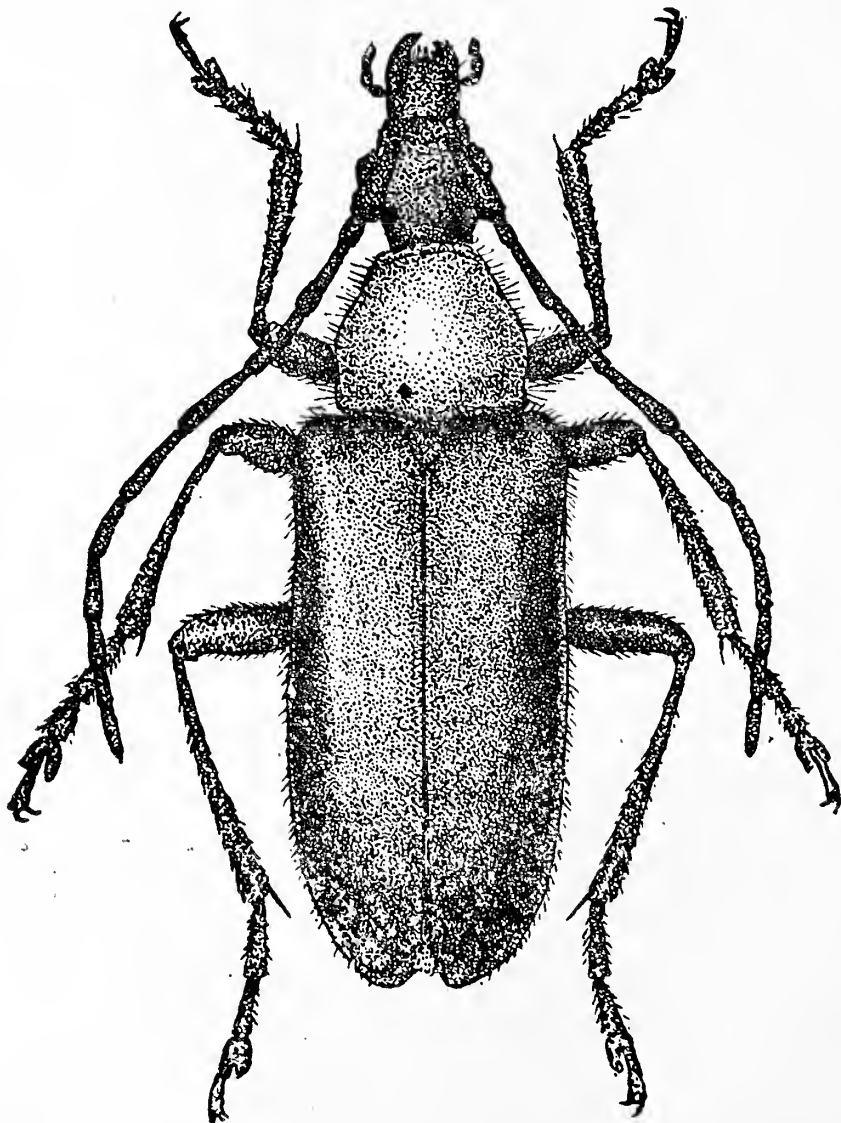


Figure 100. *Acmaeops collaris* (L.).

tarsi barely shorter than tibiae, claws notably longer than 3rd segment. Head, thorax (ventrally), and elytra black; pronotum and abdomen red. Antennae black, lustrous basally, matte apically, with gray tinge. Legs black. Length 7.0 to 9.0 mm.

Egg: White, elongate, rounded at poles, with coarse cellular sculpture giving it rough texture. Length 1.5 mm, width 0.4 mm.

Larva (Figure 101): Highly similar to larva of *Acmaeops minuta* (Geb.). Differs only in more diffuse, indistinctly demarcated anterior

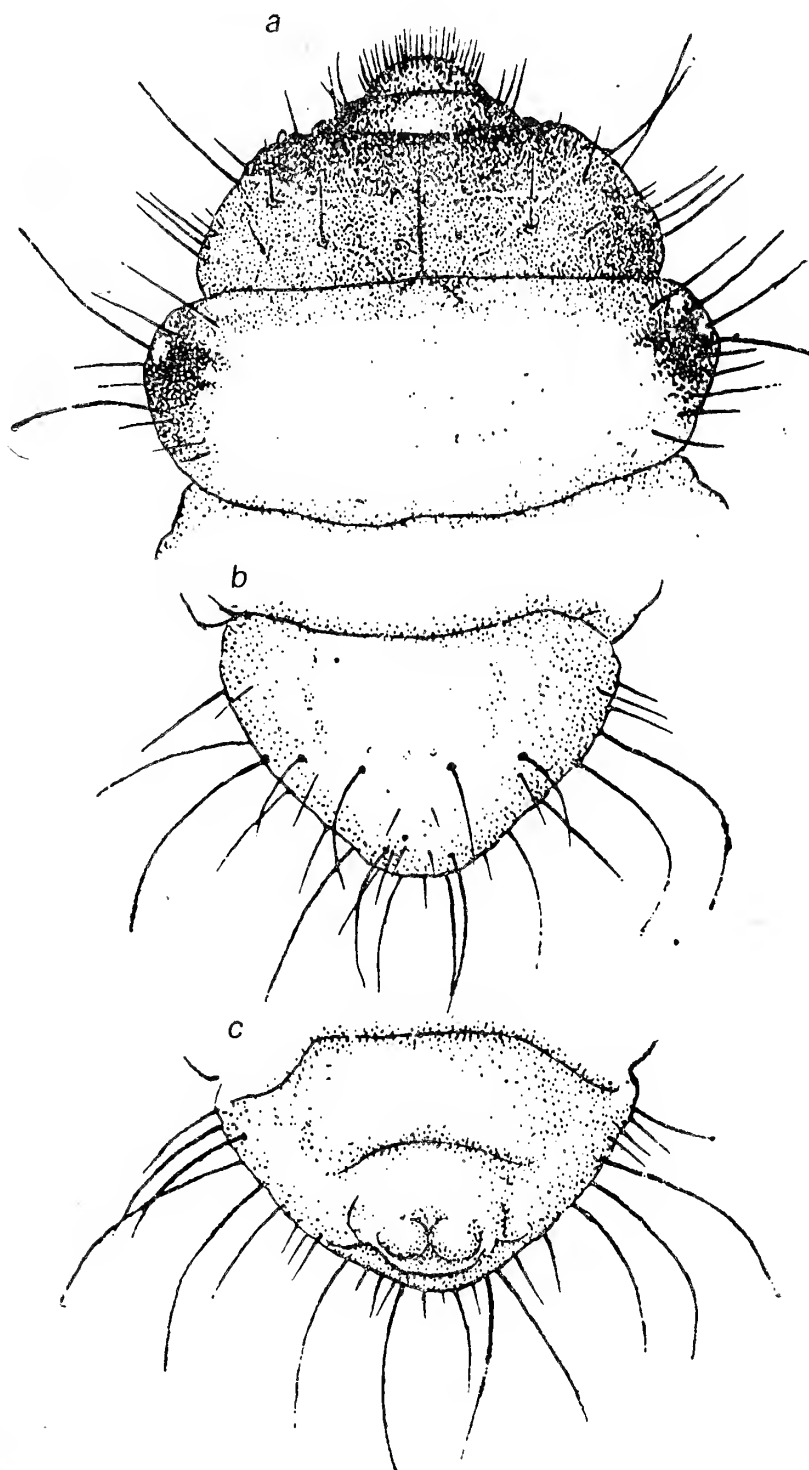


Figure 101. Larva of *Acmaeops collaris* (L.).
a—head and pronotum; b—abdominal tergite IX;
c—abdominal sternite IX.

ocelli, and more laterally produced abdominal segments. Body flat. Head transverse, narrows gently forward in posterior third, angularly broadened. Ocelli six ($3 + 2 + 1$); front ones fused, indistinctly demarcated. Clypeus broad, trapezoidal. Labrum smooth on disk, with short setae in anterior half.

Pronotum 3.0 times wider than long, rounded laterally and here with long setaceous hairs, on disk with faint fine striation. Prosternum smooth. Thoracic legs long and slender, with small, markedly broadened claws at base.

Abdominal segments sharply produced laterally, with long hairs. Tergites slightly convex, with setaceous hairs laterally (inner to spiracles) as in *Acmaeops minuta* (Gebl.). Locomotory ampullae with granules forming indistinct transverse rows. Tergite IX broad, its basal width 2.0 times length, smooth on disk, with four annular brownish setaceous pores behind middle forming transverse row, sparse setaceous hairs laterally and apically. Sternite IX smooth; eight setaceous hairs on posterior margin form transverse row. Anal lobes smooth; two or three short lateral setae at base (anteriorly) form transverse row. Body white. Head reddish or reddish-rust. Anterior margin of pronotum with yellowish transverse band, laterally with large pitch-black diffuse spot that looks smoky.

Pupa (Figure 102): Differs from pupa of *Acmaeops minuta* (Gebl.) in very large size and markedly produced coriaceous base of setae on pronotum. Body comparatively thick, convex ventrally. Head elongate, markedly bent under, transverse, barely convex, with carina between antennae; two or four long setae at base of antennae on inner side, and three laterally behind eyes. Antennae comparatively short, arcuate, flexed to sides.

Pronotum bulges, lustrous laterally, with short median longitudinal groove on hind clivus, without flange at apex; long thick setae at posterior margin on produced coriaceous base form dense transverse row interrupted medially by longitudinal groove (eight to ten paramedial setae); thin setae at anterior margin on produced coriaceous base (nine paramedial setae forming transverse row); sparse diffuse setae laterally. Mesonotum bulges slightly, with two to four lateral setae. Metanotum convex, lustrous, with narrow median longitudinal groove; in posterior half with long setae forming two tufts, eight to nine setae per tuft. Hind femora markedly directed dorsally, with setae forming apical collar.

Abdomen does not narrow markedly from base to tip; tip curves ventrad. Abdominal tergites convex, somewhat raised in posterior half, with thin setae forming transverse stripe or indistinct transverse row. Apex of tergite IX narrowly rounded, with small, less perceptible

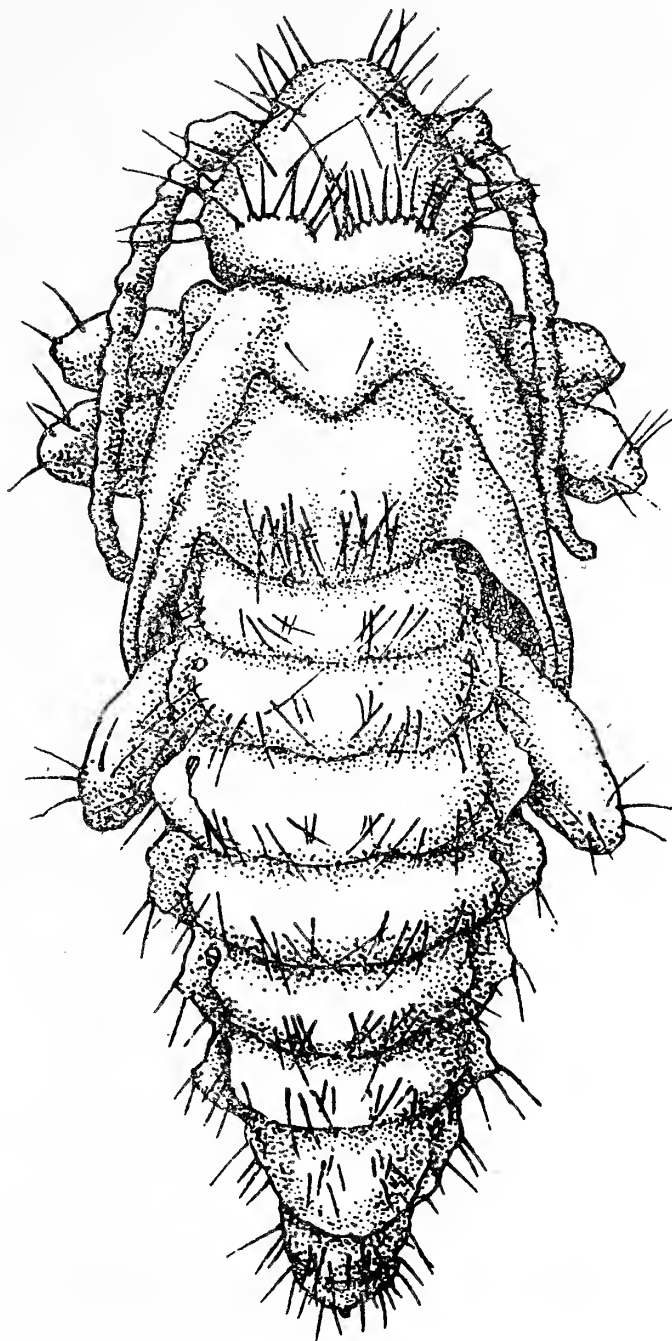


Figure 102. Pupa of *Acmaeops collaris* (L.).

spinule in male, or distinct spinule in female; pleural tubercles produced, with two or three setae directed backward. Tip of abdomen obtuse (ventral view), bound laterally with setaceous triangular carina. Valvifers of female hemispherical, laterally tubercular at apex. Length of body 7.0 to 8.0 mm, width of abdomen 2.5 to 2.8 mm.

Material: Collected in Altai, Ob' region, and Salair. Adult insects 27, larvae 15, including 10 raised from eggs laid in the laboratory, pupae—two males and one female.

Distribution: Europe, Asia Minor, Syria, Iran, northwest China. In western Siberia found in eastern Ural region, Altai (around Lake Telets), Salair, and forests in lower course of Tomsk River basin.

Biology: Inhabits deciduous and mixed vegetation. Ecologically asso-

ciated with aspen, poplar, and other deciduous wood species. Flight of beetles mainly end of June and in July. Beetles seen in June, disappear in middle 10 days of August. Feed on flowers. Ovaries of one female contained 20 mature eggs. Thin dead shoots of viable or dead trees colonized. Larvae hatch from eggs 13 to 15 days after oviposition, observed from July and August.

- 187 Larvae live in bark, make meandering or platformlike galleries under thin film of cork layer and plug them with frass consisting of bark. Larvae more often found in galleries near buds at base of thin branches. Mature larvae fall to the ground in August–September, burrow into soil to a depth of 5.0 cm, make pupal cell there, spend second winter in it, and pupate the following spring. Pupae develop under laboratory conditions at a temperature of 14 to 16°C in about 10 days. They are found from May through June. Weight of larvae falling to ground 25 to 32 mg, before pupation in soil up to 35 mg; weight of pupae 20 to 27 mg, of beetles five days after emergence 23.6 mg. Life cycle completed in two years. In 1978 in northern Caucasus I found this species on pear. In early April larvae of two generations were recorded; mature larvae found in soil, under roots, and II-instar larvae in bark of dead thin shoots. Aspen, oak, and pear colonized in the west.

12. Genus *Sieversia* Ganglb.

Ganglbauer, 1886, *Hor. Soc. Entom. Ross.*, vol. 20, p. 134; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 232–233; Gressit, 1951, *Longicorn Beetles of China*, vol. 2, p. 76 (= *Sivana*).

Adult: Distinguished by lateral tubercle on red pronotum, comparatively elongate black body, and elytra red, with parallel sides, and not very markedly convex.

Larva: Characterized by sparse coarse setae on prothorax and transversely elongate dorsal locomotory ampullae consisting of two carinae—smaller one anterior and very long one posterior.

Pupa: Setae on pronotum uniformly disposed throughout and do not form dense transverse row on posterior margin.

Only one species of this genus is known.

Types species: *Sieversia bicolor* Ganglbauer, 1886.

1. *Sieversia bicolor* Ganglb.

Ganglbauer, 1886, *Hor. Soc. Entom. Ross.*, vol. 20, p. 134; *coreana*, Okamoto, 1927, *Ins. Mats.*, vol. 2, p. 67; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 233–234.

Adult (Figure 103): Body elongate. Head barely directed forward, markedly narrows posteriorly, transversely impressed between upper

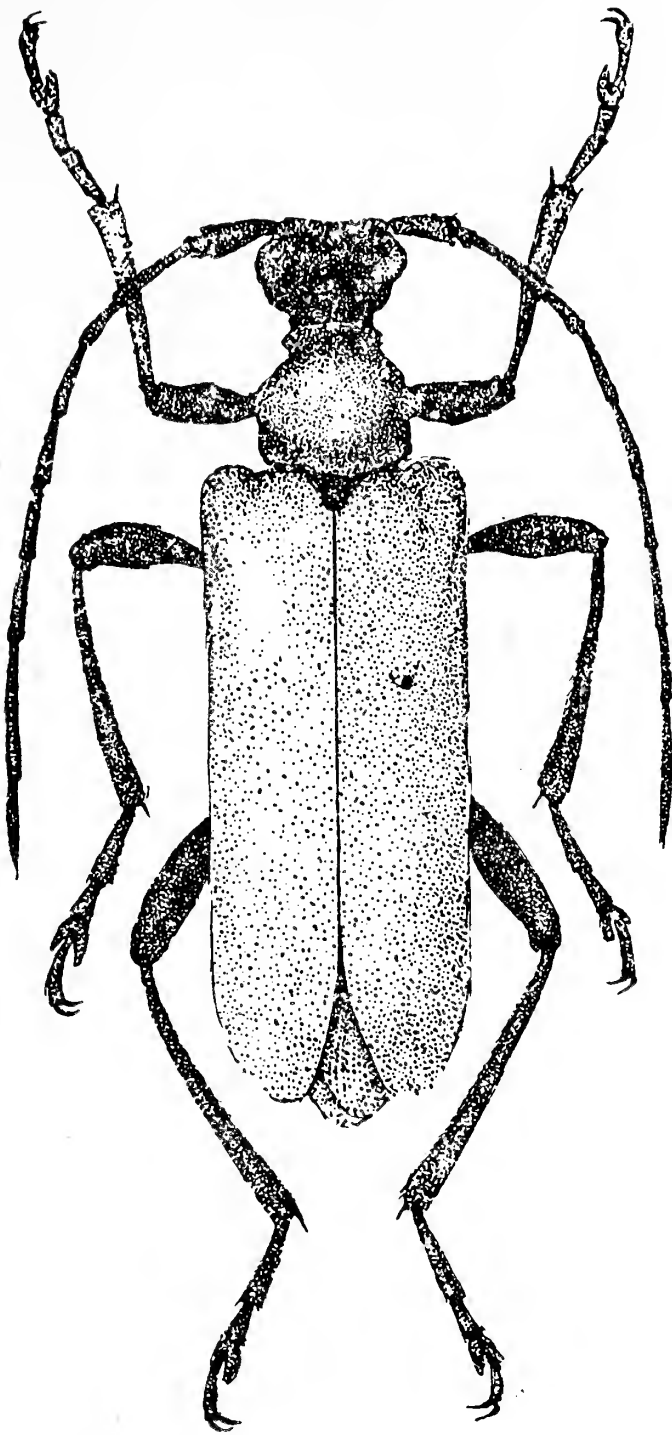


Figure 103. *Sieversia bicolor* Ganglb.

lobes of eyes, with dense punctation, and smooth median longitudinal band between antennae. Eyes bulge moderately, insignificantly emarginate. Antennae extend beyond apex of elytra in male and just beyond 0.66 their length in female. Eleventh antennal segment with appendage.

Pronotum convex and transverse (female) or not shorter than wide (male), with sharp conical tubercle laterally, deep narrow flange anteriorly, and deep transverse groove basally; with not very dense deep punctation and minute, slightly abraded hairs. Scutellum narrowly rounded posteriorly, in male broadens more basally, and with dense punctation.

Elytra more elongate and narrow in male, notably wider, slightly convex in female, rounded together apically; with dense punctation forming fine, dull colored transverse striation, and minute semiadherent red hairs. Underside of body, legs, antennae, and scutellum black. Pronotum and elytra red. Length of body 12 to 14 mm.

Egg: Silvery-white, with dense sculpture imparting fine squarrose texture, rounded at poles. Length 1.3 mm, width 0.4 mm.

Larva (Figure 104): Body moderately elongate. Head insignificantly retracted into prothorax, rounded laterally. Epistoma triangular, flat, bound by distinct frontal sutures, divided by median longitudinal brownish suture; anterior to middle with faint transverse white band, lacking

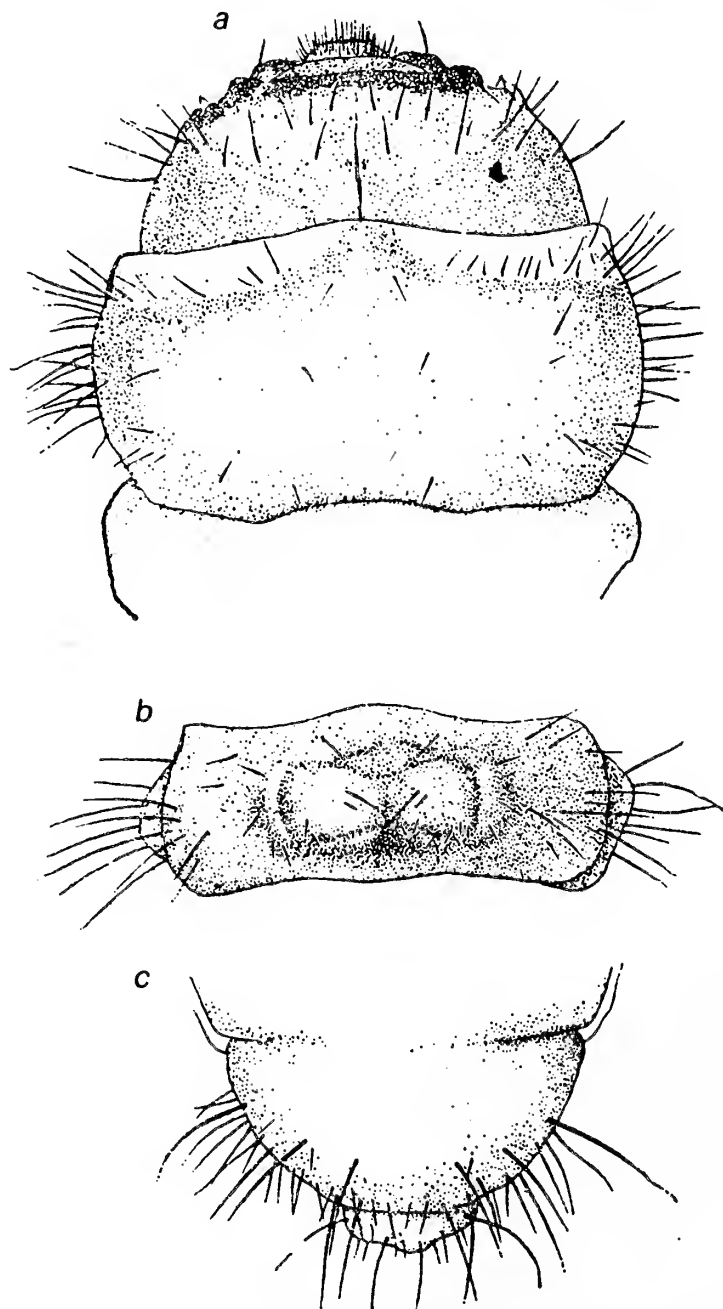


Figure 104. Larva of *Sieversia bicolor* Ganglb.

a—head and pronotum; b—abdominal tergite IV with locomotory ampulla;
c—abdominal tergite IX.

in some specimens; number of setae constant—two along sides of longitudinal suture anterior to white transverse band, two lateral forming transverse row on each side behind this band, and four broad and equidistant forming common transverse row in posterior half. Hypostoma broad, markedly narrows anteriorly, continuous, with narrow median longitudinal white band. Clypeus smooth, broad, trapezoidal. Labrum transversely elongate, broadly rounded on anterior margin, with thick, not very long setae in anterior half. Mandibles elongate, obliquely truncate at apex.

Pronotum almost 3.0 times wider than long, rounded laterally, with sparse setae on anterior margin forming transverse row, long setae forming two tufts on sides and posterior angles. Pronotal shield flat, without lateral longitudinal folds. Prosternum with sparse identical setae. Eusternum convex, triangular, with long piliform setae marginally. Legs well developed, slender; claws acicular.

Abdomen narrows gradually toward tip, with long rusty hairs laterally. Abdominal tergites transverse, only stray setaceous hairs on anterior and posterior margins. Dorsal locomotory ampullae seen on first six abdominal tergites; divided by longitudinal groove and transverse grooves into two transverse carinae, of which anterior one short and posterior one very long. Posterior carina with one to two setae on each side. Abdominal tergites VII to VIII smooth, very flat and glabrous on disk, with stray long piliform setae only on posterior margin forming transverse row. Tergite IX slightly flattened; four setae on disk in posterior half form transverse row; very dense setaceous hairs on posterior margin. Body white; pronotum on anterior margin with narrow yellowish-rust transverse band that broadens laterally. Head rusty. Mandibles black, with red tone basally. Length 15 to 20 mm; width of head 3.5 mm, of prothorax about 4.5 mm.

Pupa (Figure 105): Body moderately elongate. Head bent under; transverse prominence on vertex (behind antennae) with long piliform setae. Antennae bend around midfemora, flexed ventrad, looplike. Pronotum convex, laterally produced angularly, with indistinct flange on anterior margin (male) or without it (female), dense setae throughout entire surface. Pro- and metanota with thin setae in posterior half forming one paramedial tuft each.

Abdomen narrows gradually toward tip. Abdominal tergites convex, with tender setae directed medially in posterior half. Tergites VII to IX with long setae directed backward. Tergite IX with two nonsclerotized spinules terminally. Tip of abdomen ventrally bound by carina set with dense piliform setae. Valvifers of female small and just barely separated. Length of body 14 to 17 mm, width of abdomen 3.0 to 4.0 mm.

Material: Collected in Ussuri-Primor'e region (Komarovka River,

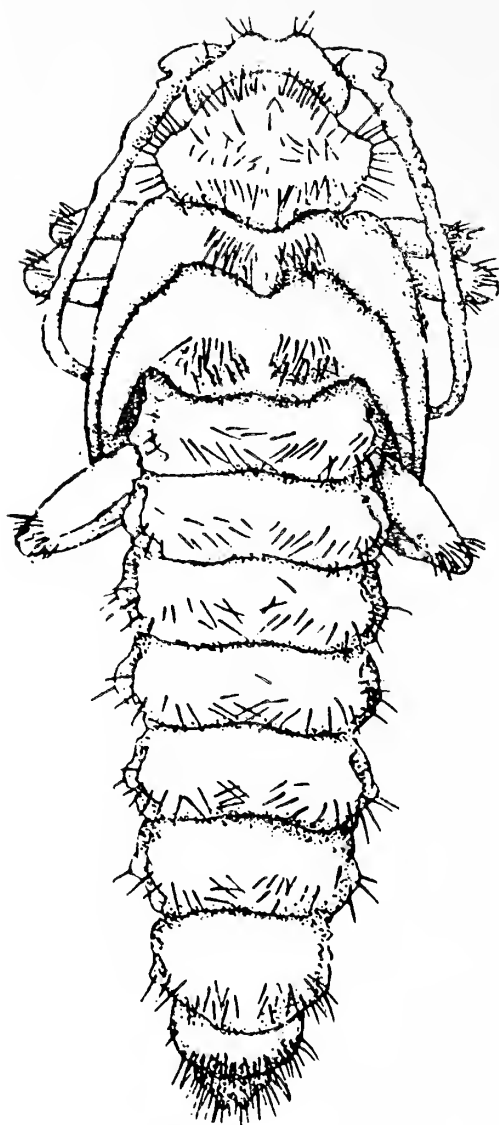


Figure 105. Pupa of *Sieversia bicolor* Ganglb.

Ovchinnikovo village, Artilleriisk Spring valley). Adult insects 21 including 16 raised in the laboratory, larvae 20, pupae 16, and larval exuviae from pupal cells with beetles 12.

Distribution: Ussuri-Primor'e region, Korea, and northeast China.

Biology: Inhabits broad-leaved forests. Ecologically associated with viable trees of *Micromeles alnifolia*. Flight of beetles observed from June through July. Beetles confined to grass cover, mate soon after emerging from cells, and female lays eggs in soil around roots of *Micromeles alnifolia*. Ovaries of one newly emerged female contained 254
190 mature eggs. This confirms the fact that these beetles do not require supplementary feeding. Embryonic development at $20.4 \pm 0.9^{\circ}\text{C}$ completed in 10 to 14 days. Thus in 1972, from eggs laid on July 7th to 11th, larvae hatched by July 28, and from eggs laid on July 11 to 16, ceased hatching by July 29.

Larvae live in soil at the root zone of viable *Micromeles alnifolia*, feed on bark, and bore galleries in it. A large number of larvae were

found on the roots of *Micromeles alnifolia* in the valleys of the Komarovka River and Artilleriisk Spring near Ovchinnikovo village. Mature larvae make pupal cell in soil, usually around roots, and later pupate in it. Sometimes pupal cells disposed vertically, in which case pupa reclines with head upward. Length of cell 16 to 18 mm, width 9.0 to 13.0 mm. Pupal cells made in soil or turf at a depth of up to 5.0 cm, near large roots or among rootlets, sometimes away from the trunk at a distance of up to 70 cm.

Pupation occurs end of May and in June. Pupae develop in two to three weeks, average 16 to 17 days. Beetles emerge from pupae mainly in last 10 days of June and early July. They remain in the pupal cell for one week, emerge, and immediately commence reproduction. Male usually emerges earlier, on the leaves of herbaceous vegetation near those trees under which female matures in soil. Weight of larvae before pupation 93 to 244 mg, pupae 83 to 221 mg, and beetles 66 to 181 mg. Total duration of life cycle not less than two years.

13. Genus *Pseudosieversia* Pic

Pic, 1902, *Echange*, vol. 18, p. 19; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 235; Gressitt, 1951, *Longicorn Beetles of China*, vol. 2, p. 76.

Adult: Characterized by different coloration of male and female, and more extended and pointed lateral tubercle on pronotum.

Larva: Characterized by presence in posterior half of epistoma (inner to frontal sutures) of not four but just two setae forming transverse row.

Pupa: Characterized by long coarse setae forming two transverse bands on pronotum (one on anterior margin, the other in middle) and one dense transverse row on anterior margin.

This genus consists of a single species, which inhabits broad-leaved forests.

Type species: Pidonia rufa Kraatz, 1879.

1. *Pseudosieversia rufa* (Kr.)

Kraatz, 1879, *Deutsch. Entom. Z.*, vol. 23, p. 101 (male *Pidonia*); *spectabilis*, Kraatz, 1879, *ibid.*, p. 228 (female *Pidonia*); *bicolor*, Heyden, 1886, *Deutsch. Entom. Z.*, p. 276 (female *Pidonia*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 235-237.

Adult (Figure 106): Proximate to *Sieversia bicolor* Ganglb. and distinguished from it by marked sexual dimorphism and better developed and sharply produced lateral tubercle on pronotum. Body in male thin and elongate, in female thicker. Head behind eyes with distinct cervix,

tubercularly convex around base of antennae, with median longitudinal suture between antennae, and with indistinct punctation. Eyes markedly convex and insignificantly emarginate on inner side. Antennae thin, longer than body in male, with 10th segment reaching beyond apex of elytra; considerably shorter in female, barely cross 0.66 length of elytra.

Pronotum smooth, markedly convex on disk, narrows anteriorly, with narrow sharp flange on anterior margin, transverse groove at 191 base produced into pointed tubercle laterally, and punctation minute, not very dense. Scutellum triangular, with indistinct fine punctation.

Elytra with parallel sides, more convex in female, individually somewhat obtuse or rounded apically, with dense merging punctation forming transverse striation, and fine adherent hairs. In male entire body, antennae, elytra, and legs monochromatic reddish rust, eyes black. In female elytra, abdomen, legs, and eyes black; prothorax red; antennae dark brown, almost black; coxae (especially forecoxae) and humeral tubercles of elytra quite often reddish rust. Length 12 to 16 mm.

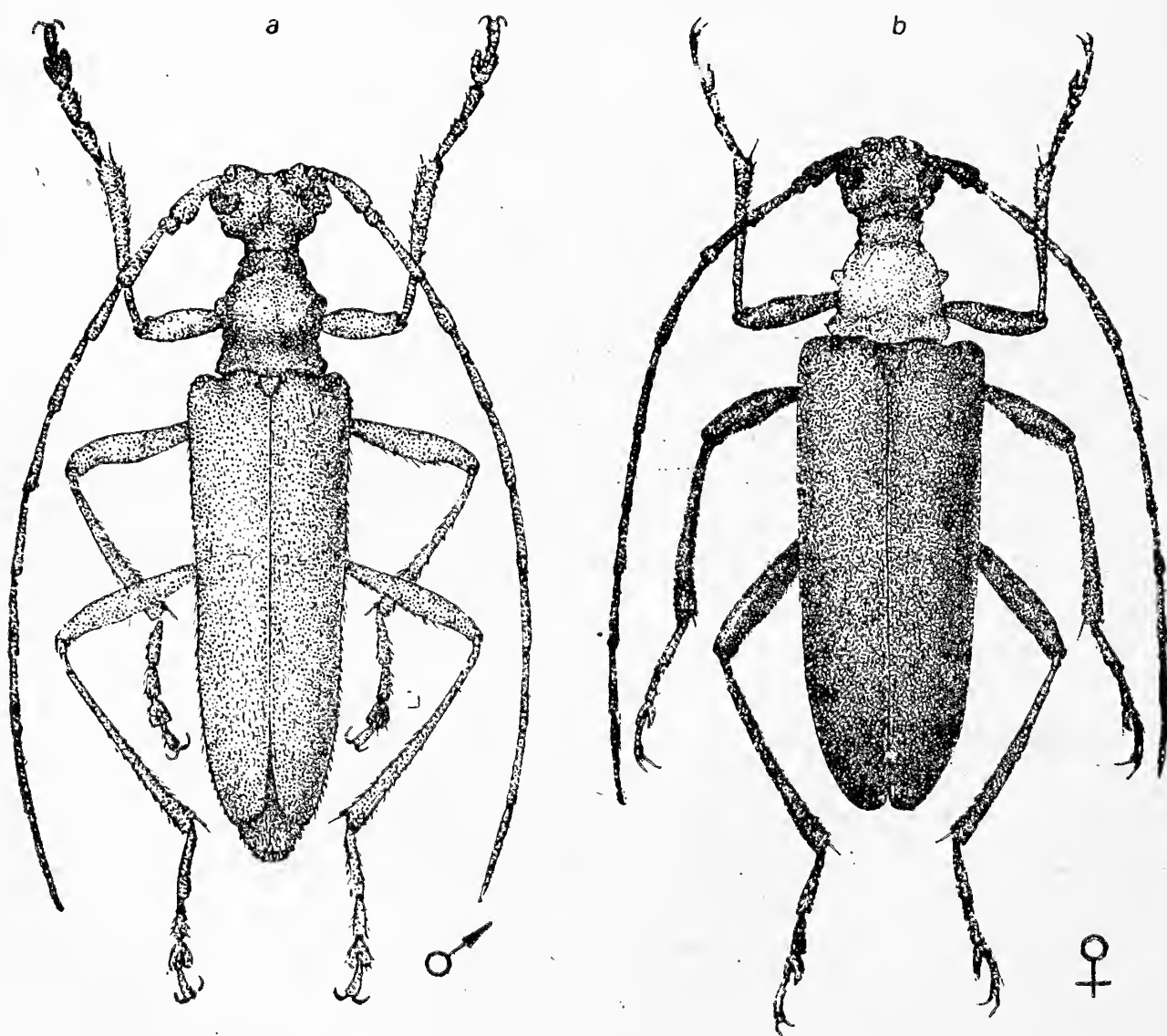


Figure 106. *Pseudosieversia rufa* (Kr.).

Egg: Elongate, slightly curved, obtusely rounded at one pole and narrows at the other; with minute squarrose sculpture; silvery-white or with faint green tinge. Length 1.4 to 1.5 mm, width 0.4 to 0.5 mm.

Larva (Figure 107): Readily distinguished from larva of *Sieversia bicolor* Ganglb. by disposition of setae on epistoma and other features. Body moderately elongate, comparatively thick. Head flat, transverse, somewhat retracted into prothorax. Epistoma triangular, bound laterally by well-developed, whitish, straight frontal sutures, and divided medially by brown longitudinal suture; four long piliform setae anterior to middle form transverse row, two long setae in posterior half form common transverse row with paired, widely separated pleural setae. Hypostoma narrows somewhat anteriorly, with four to six setae in anterior half forming indistinct transverse row. Clypeus short, broad, trapezoidal. Labrum transverse, laterally produced angularly, broadly rounded or somewhat obtuse on anterior margin, with pair of long, widely separated setae closer to base, and short brownish setae in anterior half. Mandibles obliquely truncate apically, with transverse coarse wrinkles on outer side, smooth apically.

Pronotum transversely broad, with sparse setaceous hairs in anterior half along margin of white border forming distinct transverse row (especially on sides). Similar hairs mediolaterally and at posterior angles form two transverse rows. Pronotal scutum slightly demarcated, without lateral longitudinal folds. Prosternum with stray setaceous hairs. Legs well developed, slender; claws long and acicular.

Abdomen narrows somewhat posteriorly, with sparse hairs laterally. Dorsal locomotory ampullae divided by transverse grooves into two carinae, of which posterior one very long, with three short setae on each side. Three long hairs form transverse row at base of tergites on

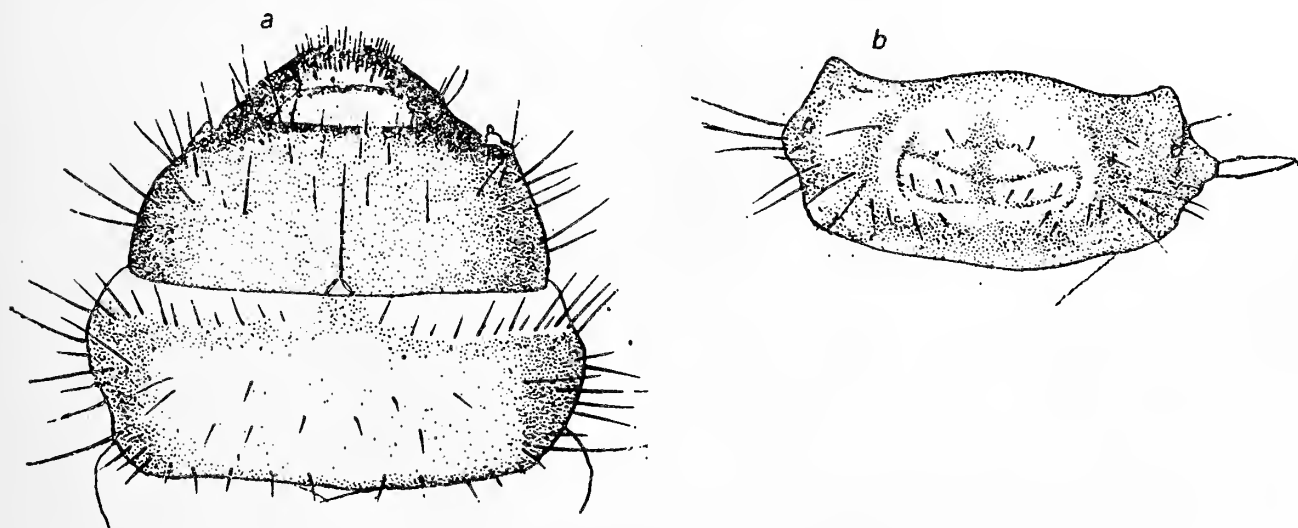


Figure 107. Larva of *Pseudosieversia rufa* (Kr.).

a—head and pronotum; b—abdominal tergite IV with locomotory ampulla.

each side of locomotory ampullae. Tergite VII smooth, without locomotory ampullae; with stray hairs on posterior margin. Anal lobes with long stray hairs. Body white, head reddish-rust, mandibles black. Pronotum with yellowish-rust tone and white border on anterior margin. Length of body 18 to 20 mm; width of head 3.0 mm, of prothorax 4.5 mm.

Pupa (Figure 108): Readily distinguished from *Sieversia bicolor* Ganglb. by dense transverse row of setae at base of pronotum. Body comparatively elongate. Three setae on head in region of genae, pili-form setae forming two pairs of tufts at base of antennae on inner side and on vertex. Antennae annular, flexed to sides, and ventrad.

Pronotum convex, narrows more anteriorly, laterally produced tubercularly, with long coarse setae on anterior margin and in middle forming two more or less distinct transverse bands, and dense trans-

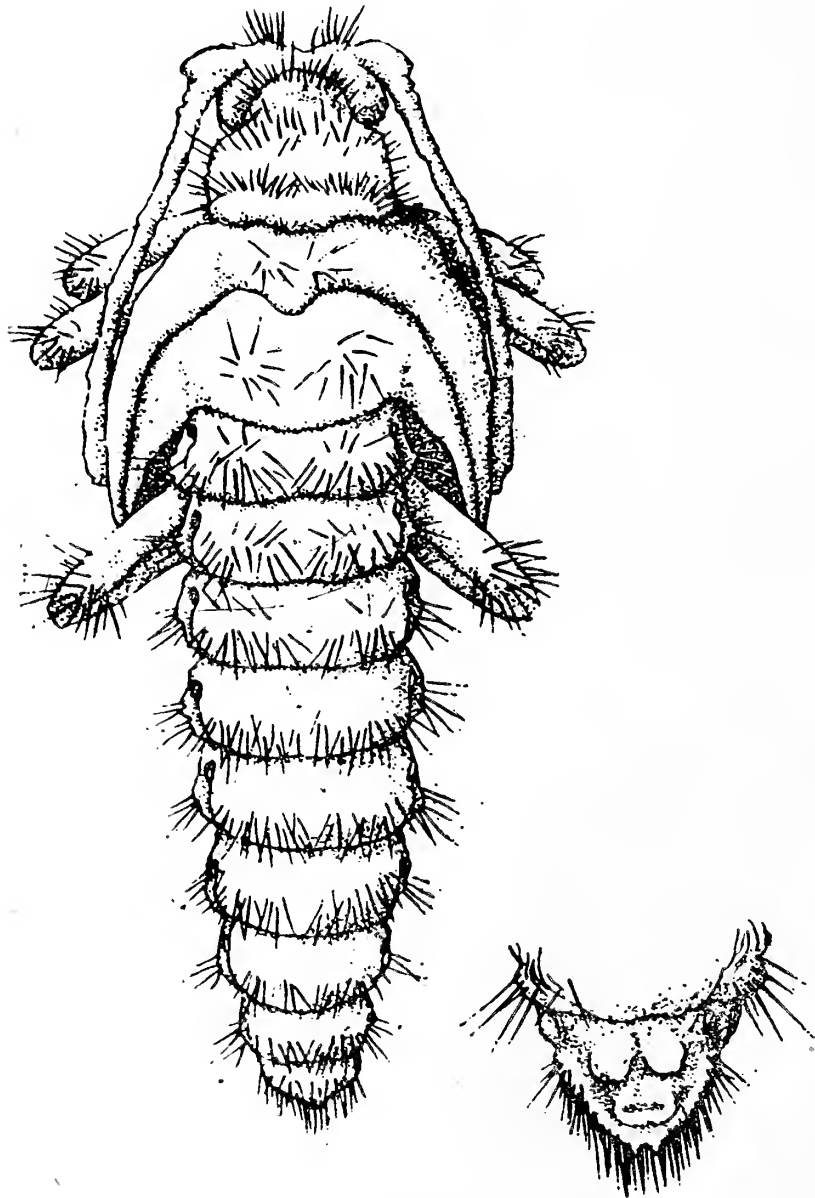


Figure 108. Pupa of *Pseudosieversia rufa* (Kr.), female.

verse row on posterior margin. Meso- and metanota with long setae forming two tufts in posterior half.

Abdomen elongate. Abdominal tergites with sparse long setae in posterior half; tergites VIII to IX with dense long piliform setae. Tip of abdomen somewhat impressed ventrally, bound by horseshoe-shaped carina set with two faint nonsclerotized terminal spinules. Valvifers of female small, slightly elongate, and contiguous. Length of body 13 to 18 mm.

Material: Collected in Ussuri-Primor'e region. Adult insects 65 including 54 raised in the laboratory, larvae 44, pupae 28, and larval exuviae from pupal cells 50.

Distribution: Ussuri-Primor'e region; northeast China, Korea. Found in zone of broad-leaved forests.

Biology: Ecologically associated with Manchurian walnut (*Juglans mandshurica*) and Manchurian ash (*Fraxinus mandshurica*). Inhabits broad-leaved forests in lower terraces of river valleys. Flight of beetles commences in last few days of June and ceases end of July or early August. Beetles maximum mid-July. Very rarely sighted on flowers. Males appear earlier, hide in herbaceous cover, quite often settle on leaves of herbaceous vegetation under crowns of trees where females are developing in soil. In this respect its biology is similar to that of *Sieversia bicolor* Ganglb. By watching the male, I discovered the nesting place of the female developing under roots. On emerging from soil she mated immediately. Beetles do not require supplementary feeding as they emerge with developed gonads. One female raised in the laboratory in a weighing jar laid 46 eggs on the second day without fertilization. Ovaries of one female that had just emerged from soil contained 122 mature eggs. After mating, female lays eggs on bark of viable trees in [zone of neck of trunk and thick roots. Eggs develop from the moment of oviposition to hatching of larvae at 20°C in 10 to 14 days, average 12 days.

Young larvae bore into bark of basal zone of trunks and thick roots covered with soil. Mature larvae move freely in soil, nibble extensive platformlike areas on bark surface, and remain mainly in root neck zone. Found quite often on thick roots, more often in recesses of roots. Mature larvae before pupation make pupal cells in soil at a depth of 4.0 to 5.0 cm, sometimes 10 to 15 cm away from trunk. Rotatory movements tamp the soil adhering to the pupal cell and polish the inner walls. Length of cell 15 to 18 mm, width 10 to 12 mm.

Pupa lies horizontal in cell with dorsal side up. Pupation of larvae in cells commences end of May at a soil temperature of 10 to 12°C, and ceases mid-June. Pupae maximum in second half of June. Beetles emerge from pupae in last 10 days of June and first half of July. Pupal

period in nature varies from 13 to 25 days, average 17.9 ± 0.7 days for male, and 20.5 ± 0.8 days for female. Beetles slough pupal exuvia and normalize by the third or fourth day but remain in the cell for about one week. Emergence of beetles from soil commences end of June and ceases mid-July. In some less-warmed places emergence of beetles is delayed by one or two weeks. Total duration of life cycle not less than two years. Weight changes significantly during metamorphosis (Table 8). Weight reduction is far greater during the formation of adults from pupae than during the formation of pupae from prepupae in cells. Weight loss is greater in males than in females.

Table 8. Weight variation in *Pseudosieversia rufa* (Kr.) during metamorphosis (mg)

Stage	n	min	max	M \pm m	%
Male					
Larva	24	63.2	147.6	103.7 ± 4.3	100.0
Pupa	24	59.0	138.5	95.9 ± 3.9	92.4
Adult	24	32.5	81.5	54.0 ± 2.3	52.1
Female					
Larva	11	126.1	266.8	196.9 ± 11.5	100.0
Pupa	11	119.5	249.0	185.6 ± 11.0	94.2
Adult	11	70.0	168.3	121.6 ± 8.7	61.7

14. Genus *Pidonia* Muls.

Mulsant, 1863, *Hist. Nat. Col. Fr. Longicorn*, vol. 2, p. 570; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 237-254 (*Pseudopidonia*); Gressitt, 1951, *Longicorn Beetles of China*, vol. 2, pp. 70-73; Hayashi, 1968, *Bull. Osaka J. Women's Jr. College*, vol. 3, pp. 7-15.

Adult: Distinguished by moderately elongate body. Head with dense punctation and sharp flange in cervical region. Temples long, abruptly rounded posteriorly. Eyes bulge markedly and slightly emarginate. Antennae thin, comparatively long, reach beyond apex of elytra (male) or reach midlength of hind clivus (female). Pronotum bulges markedly, rounded laterally [*P. amentata* (Bat.)] or angularly produced (*P. suvorovi* Baekm.). Elytra obtuse apically, with rounded angles (subgenera *Mumon*, *Pseudopidonia*) or rounded together with straight inner angles (subgenus *Omphalodera*). Legs slender; hind tibiae usually longer than tarsi.

Larva: Body flat ventrally, thoracic legs developed, locomotory ampullae developed on first six abdominal segments, mandible elongate, with trifid apex.

Pupa: Body usually C-shaped, with long setae on upper side and at apex of femora. Antennae flexed to sides, curved ventrad, annular in second half. Tip of abdomen (ventral view) obtuse, bound by carina laterally, posteriorly forming sharp elongate angle, and set with dense long piliform setae.

The fauna of northern Asia includes nine species of this genus, mainly inhabiting broad-leaved forests. Larvae develop in and under bark of different wood species and burrow into soil for pupation. Fauna of Japan richest in species composition.

- 195 This genus presumably is young in evolution. Its differentiation especially within the subgenus *Pseudopidonia*, proceeded mainly after the formation of the islands of Japan, which became isolated from the mainland.

Type species: *Leptura lurida* Fabricius, 1792.

KEY TO SPECIES

Adult Insects

- 1 (2). Elytra monochromatic, straw-yellow (subgenus *Mumon*). Length 6.0 to 8.5 mm. 1. *P. debilis* (Kr.).
- 2 (1). Elytra different in color, usually not monochromatic. If monochromatic, dark brown or almost black.
- 3 (16). Elytra obtuse apically, with rounded angles (subgenus *Pseudopidonia*).
- 4 (5). Elytra monochromatic dark brown, pronotum black. Length 8.5 to 12.0 mm. 2. *P. suvorovi* Baekm.
- 5 (4). Elytra usually not monochromatic. If monochromatic, pronotum entirely red (*P. alticollis* var. *tristicula*, female).
- 6 (15). Pronotum black. If red, with black spot laterally.
- 7 (8). Pronotum slightly narrows anteriorly, laterally rounded, without flange on anterior margin. Length 6.0 to 7.0 mm. 3. *P. amentata* (Bat.).
- 8 (7). Pronotum markedly narrows anteriorly, with flange on anterior margin.
- 9 (10). Pronotum black. Elytra straw-yellow, with black longitudinal bands laterally, broad blackened suture. Length 6.0 to 9.0 mm. 4. *P. quercus* (Tsher.).
- 10 (9). Pronotum red, with black spot laterally. If black, beetles large.
- 11 (14). Sexual dimorphism poorly manifest, male and female same in color. Elytra light rust, with blackened suture and black longitudinal band laterally.

- 12 (13). Pronotum red, with broad black spot laterally. Length 11 to 13 mm. 5. *P. similis* (Kr.).
- 13 (12). Pronotum black. Length 9.0 to 12.0 mm. 6. *P. gibbicollis* (Bless.).
- 14 (11). Sexual dimorphism sharp: elytra in male straw-yellow, with darkened suture and transverse black band on hind clivus; elytra in female black, with rusty spots (var. *amurensis* Pic). Length of male and female 6.0 to 10.0 mm. 7. *P. amurensis* (Pic).
- 15 (6). Pronotum entirely red. Elytra in male straw-yellow, in female black (var. *tristicula* Kr.). Length of male and female 7.0 to 8.5 mm. 8. *P. alticollis* (Kr.).
- 16 (3). Elytra not obtuse apically, rounded together, with straight inner angles (subgenus *Omphalodera*). Length 5.0 to 8.0 mm. 9. *P. puziloi* (Sols.).

Larvae

- 1 (2). Sternite IX with six long piliform setae on posterior margin forming transverse row (subgenus *Mumon*). 1. *P. debilis* (Kr.).
- 2 (1). Sternite IX with four long piliform setae on posterior margin.
- 196 3 (14). Hypostoma invariably with two widely separated, well-developed setae (subgenus *Pseudopidonia*).
- 4 (13). Prothoracic eusternum with only two widely separated setae at apex. Additional seta lacking between them.
- 5 (8). Posterior transverse carina of dorsal locomotory ampullae without setae.
- 6 (7). Ocelli behind antennal base not fused, form transverse band consisting of three minute black spots. 3. *P. amentata* (Bat.).
- 7 (6). Ocelli behind antennal base fuse into common transverse black band; boundaries between them visible only under high magnification. 4. *P. quercus* (Tsher.).
- 8 (5). Posterior transverse carina of dorsal locomotory ampullae with developed setae.
- 9 (10). Ocelli distinctly separate; transverse band behind antennal base consists of three black spots. 5. *P. similis* (Kr.).
- 10 (9). Ocelli not demarcated, form continuous oval black spot behind antennal base, and separate only in freshly molted larvae.
- 11 (12). Posterior carina of dorsal locomotory ampullae with long

- setae, with additional short paramedial setae on posterior tergites. 6. **P. gibbicollis** (Bless.).
- 12 (11). Posterior carina of dorsal locomotory ampullae with minute indistinct setae only on tergites IV to VI. 7. **P. amurensis** (Pic).
- 13 (4). Prothoracic eusternum with three setae at apex, the third quite short and disposed between long lateral setae closer to anterior margin. 8. **P. alticollis** (Kr.).
- 14 (3). Hypostoma without perceptible setae, smooth (subgenus *Omphalodera*). 9. **P. puziloi** (Sols.).

Pupae

- 1 (2). Pronotum basally with six to eight setae forming diffuse row, without flange at apex, with straight unraised margin (subgenus *Mumon*). 1. **P. debilis** (Kr.).
- 2 (1). Pronotum with 16 to 40 setae set on produced base, forming dense transverse row.
- 3 (10). Pronotum markedly narrows anteriorly, usually with flange at apex, with raised anterior margin, and laterally broadens angularly (subgenus *Pseudopidonia*).
- 4 (9). Pronotum basally with 16 to 30 setae forming transverse row, usually interrupted medially.
- 5 (6). Pronotum basally with 16 to 18 setae. 4. **P. quercus** (Tsher.).
- 6 (5). Pronotum basally with 22 to 30 setae.
- 7 (8). Abdominal sternites laterally with long piliform setae. 5. **P. similis** (Kr.).
- 8 (7). Abdominal sternites laterally without long piliform setae. 7. **P. amurensis** (Pic).
- 9 (4). Pronotum basally with 38 to 40 setae forming transverse row, usually recurved and not interrupted medially. 8. **P. alticollis** (Kr.).
- 10 (3). Pronotum narrows somewhat anteriorly, without flange at apex, and laterally rounded (subgenus *Omphalodera*). 9. **P. puziloi** (Sols.).

197 1. *Pidonia debilis* (Kr.)

Kraatz, 1879, *Deutsch. Entom. Z.*, vol. 23, p. 104 (*Grammoptera*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 241-242 (*Pseudopidonia*); Hayashi, 1968, *Bull. Osaka J. Women's Jr. College*, vol. 3, pp. 15-16.

Adult (Figure 109): Distinguished by monochromatic reddish-rust color of body and darkened apex of hind femora. Body elongate, broader

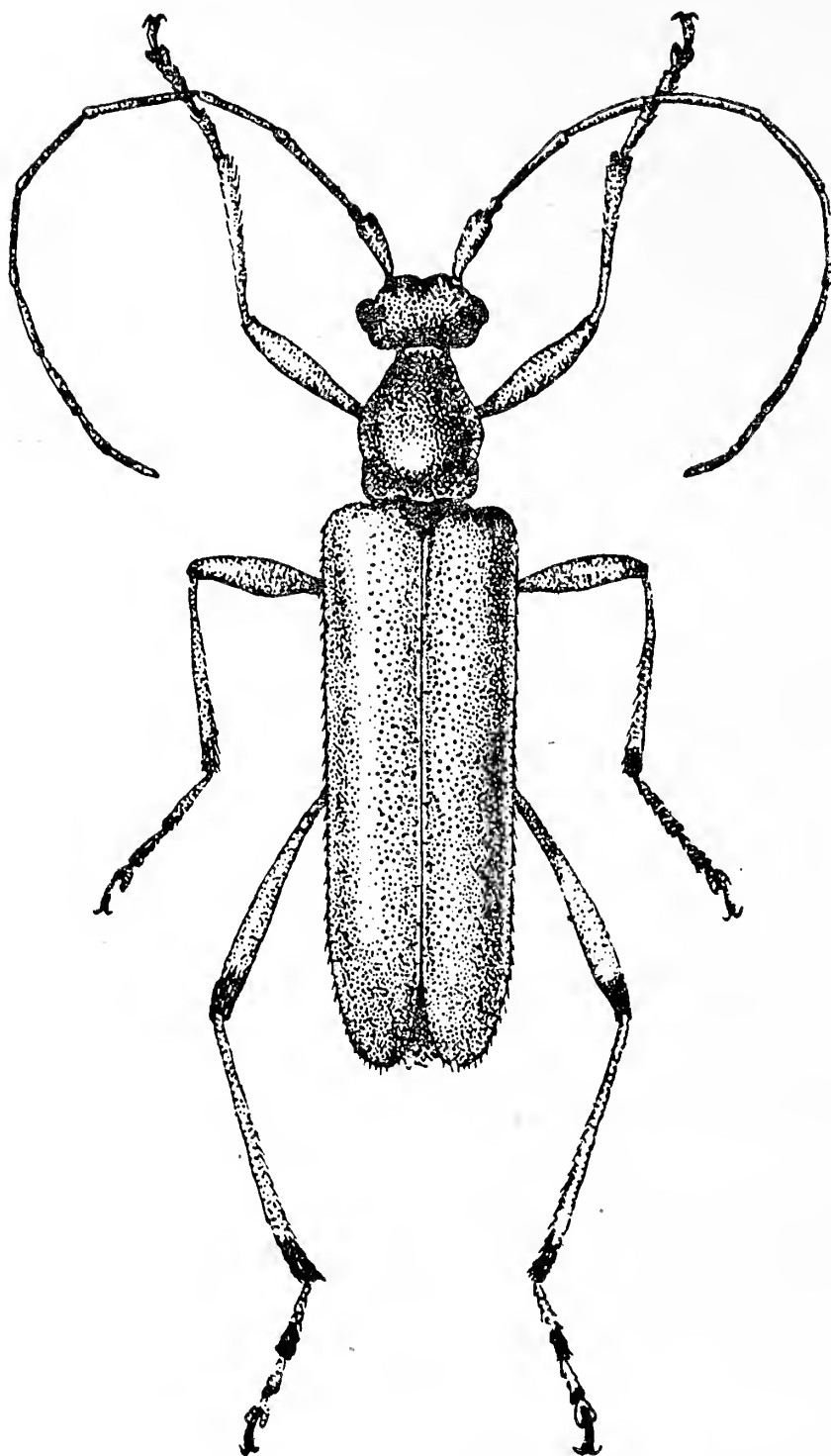


Figure 109. *Pidonia debilis* (Kr.).

in female. Head with rather shallow minute punctation, bulges transversely between antennae, with narrow median longitudinal suture and sharp cervix behind eyes. Temples rounded, with long hairs. Antennae thin; 11th segment hardly reaches apex of elytra in male. Eyes large and convex, slightly emarginate.

Pronotum with almost parallel sides, markedly narrows in anterior third, with distinct flange on anterior margin, sometimes with narrow transverse groove at base, more distinct laterally, with comparatively dense even punctation and silky adherent hairs. Legs long and slender. Hind tibiae straight; 1st segment of hind tarsi longer than successive

ones together. Scutellum narrow, posteriorly pointed, with dense punctation.

Elytra elongate, with parallel sides, more broadly convex in female, obtusely rounded apically, with dense very large punctation basally, and yellowish semiadherent hairs. Head, thorax, and abdomen reddish-rust; eyes black. Elytra straw-yellow. Antennae rusty, blackened toward apex, usually only distal part blackened commencing from 3rd or 5th segment. Legs very light colored, rusty-yellow. Apex of hind femora, apex of hind tibiae, partly hind tarsi, and sometimes mid-tarsi dark brown or black. Length of body 6.0 to 8.0 mm.

Egg: Silvery-white, moderately elongate, rounded at poles, with cellular sculpture. Cells longitudinally elongate, with thin septa in between. Length 1.0 mm, width 0.4 mm.

Larva (Figure 110): Distinguished by structure of ocelli and arrangement of hairs on abdominal sternite IX. Head flat, slightly retracted into prothorax, and narrowly rounded anteriorly. Ocelli three, form
198 black transverse band behind antennae. Epistoma bound by well-developed white frontal sutures, divided by well-developed longitudinal suture (sutura medialis) apically, with two pairs of hairs in middle forming transverse row, one pair of hairs in posterior half closer to apex forming common transverse row with parietal setaceous hairs, of which inner ones disposed on frontal sutures and outer ones laterally, equidistant from each other. Hypostoma flat, narrows anteriorly, with pair of widely separated setaceous hairs. Clypeus broad, short, slightly convex, trapezoidal. Labrum transverse, rounded anteriorly, with short stiff setae. Mandibles elongate, deeply notched apically in upper half, gently truncate in lower half, with produced dentate lower angle. With time, this angle wears down, becomes rounded, and mandibles thus appear apically bifid.

Pronotum slightly convex, flat on disk, 3.0 times wider than long; narrow transverse yellow band in anterior half, closer to apex, somewhat elongate anteromedially, interrupted medially by whitish longitudinal clearance; setaceous hairs laterally in front of yellowish band form transverse row, and similar hairs present at posterior angles. Pronotal shield merges with rest of surface, not demarcated laterally. Prosternum smooth, with stray piliform setae. Eusternum with pair of setae on anterior margin. Thoracic legs well developed, with somewhat sclerotized claws.

Abdomen ventrally flat. Abdominal tergites moderately convex, with long hairs laterally. Dorsal locomotory ampullae occur on first six segments, divided into two smooth transverse carinae, of which posterior one more elongate; with stray, barely perceptible setae or, more often, without them. Tergite VII smooth, glabrous on disk, with long hairs

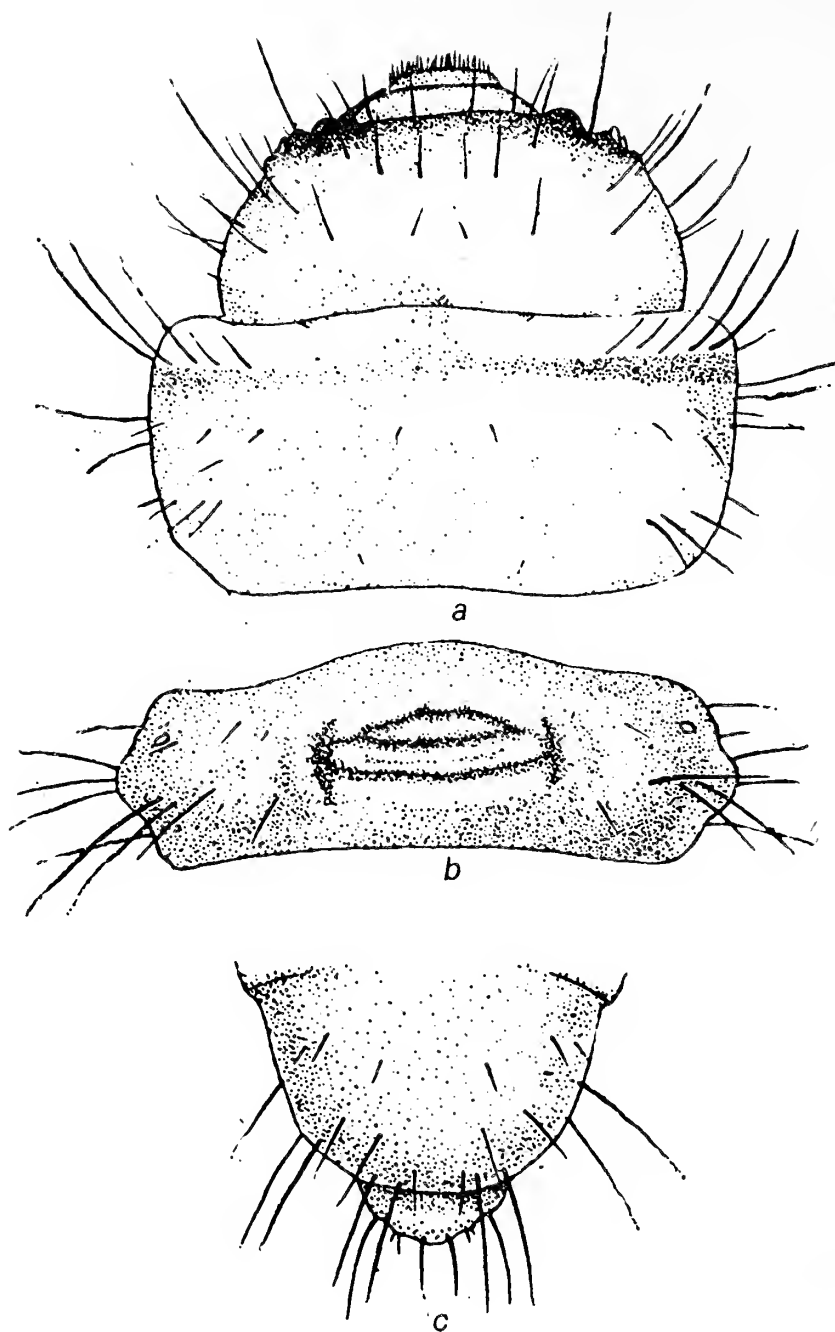


Figure 110. Larva of *Pidonia debilis* (Kr.).
a—head and pronotum, b—abdominal tergite IV with locomotory ampulla; c—abdominal tergite IX.

laterally in posterior half forming transverse row. Sternite IX with six setaceous hairs on posterior margin. Anal lobes glabrous or with faint short setae basally. Length of body up to 8.0 to 9.0 mm, width of head 2.0 mm.

199 *Pupa* (Figure 111): Body elongate, with tip of abdomen bent under. Head markedly bent under. Frons broad, with narrow median brownish line, and stray setae on inner side and in front of antennae forming row around antennae. Antennae annular, flexed to sides of elytra.

Pronotum convex, slightly bent under, narrows anteriorly, with raised anterior margin, with long setae on produced base here, sparse scattered setae on disk; posterior margin uniform, not raised, with sparse

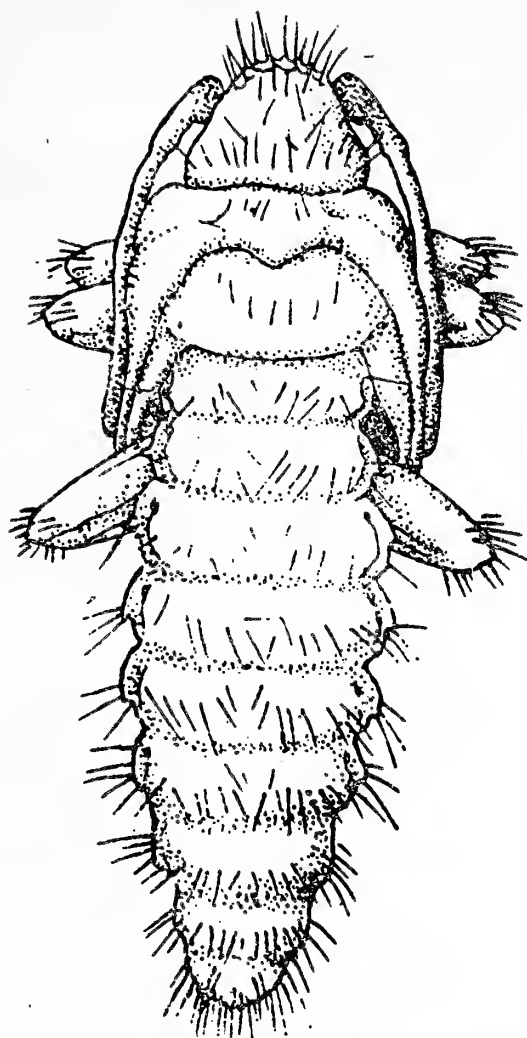


Figure 111. Pupa of *Pidonia debilis* (Kr.).

setae in front of margin (receding forward) forming transverse row. Mesonotum with five to six setae in single row. Metanotum broad, slightly convex, with sparse setae forming transverse recurved row.

Abdomen markedly narrows posteriorly and bent under. Abdominal tergites bulge moderately and uniformly, with sparse long piliform setae in posterior half. Tergite IX with faint, sometimes bifurcate, nonsclerotized spinule at apex or spinule negligible, and with long hairs. Length of body 5.0 to 6.5 mm, width of abdomen 2.0 mm.

Material: Collected in Ussuri-Primor'e forests. Adult insects 258, larvae 18, pupa one, larval exuviae from cells with beetles two.

Distribution: Amur region, Ussuri-Primor'e region, Sakhalin; north-east China, Korea, Japan. Maximum in broad-leaved forests of Ussuri, Khasan, Partizan, and other regions of the Far East.

Biology: Inhabits broad-leaved forests including ash (*Fraxinus* sp.) and Manchurian striped maple (*Acerus tegmentosum*). Flight of beetles commences in June, extends up to August. In 1972 to 1973 during systematic collections, of 238 beetles 7.5% were collected in last 10 days of June, 53.8%—first 10 days of July, 18.1%—second 10 days, and 20.6%—last 10 days of July. Beetles in flight found in large numbers

on flowers of Umbelliferae and Rosaceae, and avidly seek out lilac (*Syringa*). Female lays eggs on ash and Manchurian striped maple. Beetles colonize thin shoots of these species in gardens. Egg development at 18.8°C takes 12 to 18 days, average 14.2 days.

Larvae first appear in nature in early July but hatch en masse end of July and early August. On breaking through the chorion larva immediately bores into bark, initially makes gallery there, and later under bark along shoot or spirally around it, plugging it from behind with frass consisting of bark and wood. Galleries under bark impressed on wood. Width of gallery 3.0 to 4.0 cm, length up to 5.0 cm. Mature larvae nibble oval opening (1.5 mm × 2.5 mm) on bark surface and fall through it to soil, making pupal cell there. Width of pupal cell 5.0 to 6.0 mm, length 6.0 to 7.0 mm. Larvae appear on soil in autumn and spring.

- 200 Pupation (in cells) commences in May and ends early June. Pupae maximum in middle 10 days of June. Earliest beetles found in soil on June 19. Beetles emerge en masse from pupae in last 10 days of June and usually remain in soil for not more than one week, exiting from it from last 10 days of June. Emergence ceases early in middle 10 days of July. Weight of larvae in soil 11.5 to 26.0 mg, pupae 11.0 to 20.5 mg, and adults 7.0 to 12.5 mg. Considerable weight reduction occurs during formation of adults from pupae. For example, one pupa weighed 18.5 mg and the emerged adult only 11.0 mg; in another example the weights
201 were respectively 16.0 mg and 9.8 mg. This species colonizes thin shoots of decaying and freshly fallen trees and trunks of undergrowth up to 4.0 cm in diameter. *Acmaeops minuta* (Geb.) often found together with this species on ash and Manchurian striped maple.

2. *Pidonia suvorovi* Baekm.

Baekmann, 1903, *Rev. Russ. d'Entom.*, vol. 3, p. 115; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 250–251 (*Pseudopidonia*); Hayashi, 1969, *Bull. Osaka J. Women's Jr. College*, vol. 4, pp. 81–82.

Adult (Figure 112): Body moderately elongate. Head between antennae with longitudinal suture, dense punctation, and distinct cervix. Temples smooth, with long erect hairs, sparse smoothened fine punctation. Eyes markedly convex, slightly emarginate. Antennae thin, reach somewhat beyond apex of elytra (male) or only up to hind clivus (female).

Pronotum mediolaterally broadens angularly, markedly narrows anteriorly, with small flange at apex, on disk with smooth median longitudinal prominence, and dense round punctation; pubescence in female minute and indistinct, in male consists of very long adherent hairs. Scutellum small and triangular, narrowly rounded posteriorly, with minute punctation.

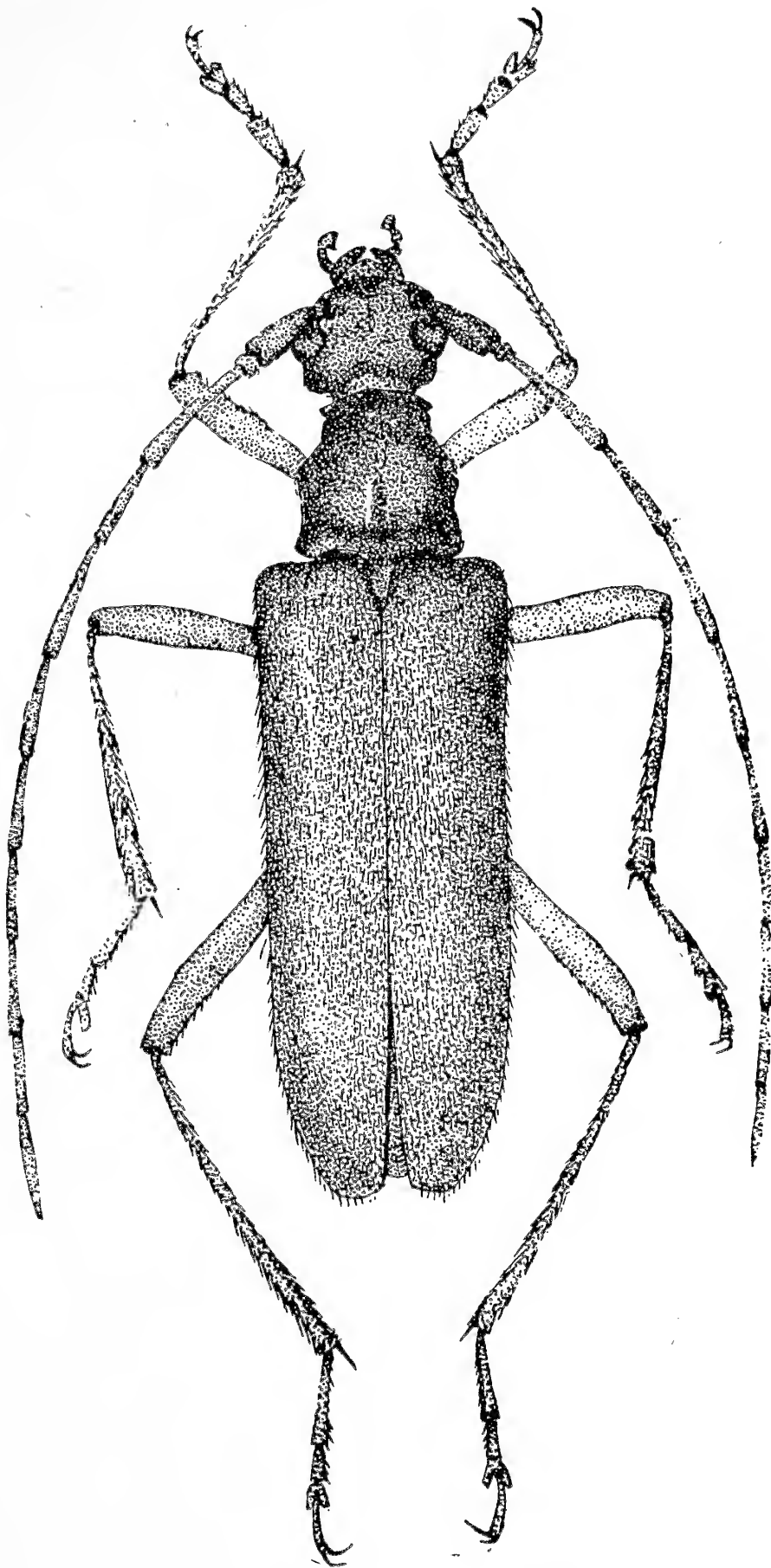


Figure 112. *Pidonia suvorovi* Baekm.

Elytra convex, with parallel sides, somewhat obtuse posteriorly, rounded at angles, with large punctation in anterior half (especially at base) that reduce anteriorly; with short light-colored hairs. Legs slender. Hind tarsi shorter than tibiae; 1st tarsal segment not longer than two successive ones. Body black. Elytra monochromatic, black. Antennae light rust (male), sometimes with darkened or rusty-brown apex (female). Legs rusty, with brown tone on mid- and hind tibiae (male) or more darkened on tibiae and mid- and hind femora (female). Length of body 8.5 to 12.0 mm.

Distribution: Ussuri-Primor'e region; North Korea. Known from Barabash and Pos'et.

Biology: Not definitively known. Beetles appear in second half of June, sighted in August. Collection consists of two beetles from Primor'e (Pos'et).

3. *Pidonia amentata* (Bat.)

Bates, 1884, *J. Linn. Soc. Lond. Zool.*, vol. 28, pp. 215-216 (*Grammoptera*); Hayashi, 1968, *Bull. Osaka J. Women's Jr. College*, vol. 3, pp. 24-25.

Adult (Figure 113): Similar in general habits to *Pidonia quercus* (Tsher.). Differs in yellow preantennal band which joins with yellowish-rust clypeus, and absence of flange on anterior margin of pronotum. Body comparatively stocky, small. Head between antennae barely raised transversely, and with dense minute merging punctation and yellow adherent hairs. Temples project sharply. Antennae barely reach (male) or do not reach apex of elytra (female).

Pronotum gently rounded laterally, insignificantly narrows anteriorly, sloping straight toward apex, without perceptible flange on anterior margin, elongate, bulges markedly on disk (but not cowl-shaped); with dense merging punctation (thus appears granulate) and light-colored adherent hairs.

Elytra bulge, with parallel sides, broaden more in female; with comparatively uniform, rather minute punctation and light-colored hairs; broadly rounded apically. First segment of hind tarsi somewhat longer than two successive together. Body black. Clypeus and genae rusty. Elytra straw-yellow, along suture with broad black band, laterally behind humeri with black elongate longitudinal spot, and longitudinal black band in middle. Antennae rusty or rusty-brown, sometimes with darkened apical segments. Legs rusty; apices of femora and tibiae usually of hind and sometimes of midlegs black. Tarsi dark brown. Fore-legs more often entirely rusty. Length of body 6.0 to 7.0 mm.

Egg: White, elongate, narrows gently, and almost uniformly rounded at poles, with fine noncellular sculpture. Length 1.0 mm, width 0.4 mm.

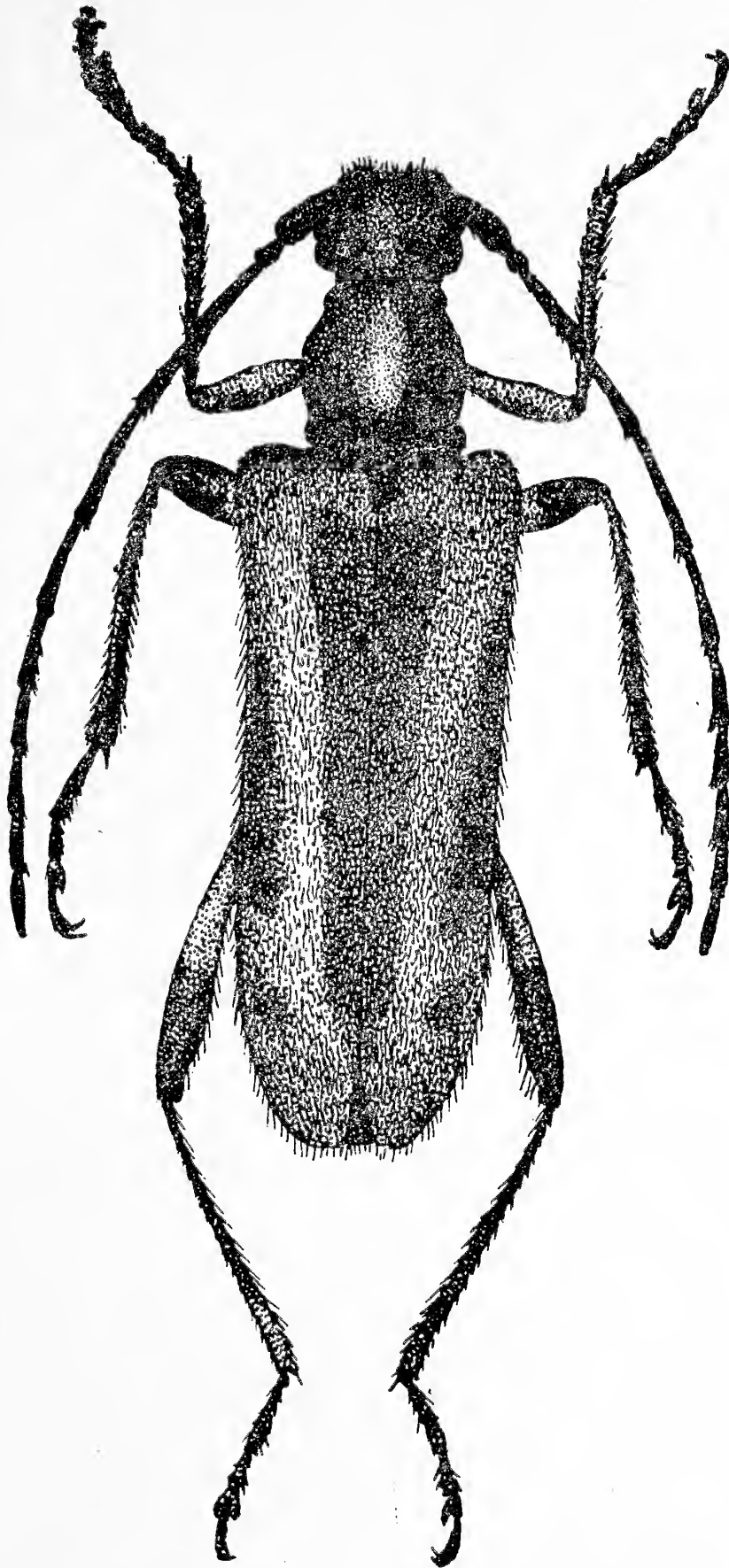


Figure 113. *Pidonia amentata* (Bat.).

Larva: Head laterally rounded. Epistoma with four setaceous hairs forming transverse row anterior to middle and two hairs forming transverse row in posterior half together with pleural setae of suture. Hypostoma trapezoidal, notably narrows anteriorly. Legs well developed. Mandibles trifid. Ocelli three, well differentiated, form transverse band.

Abdomen elongate. Abdominal tergites moderately convex, with long setae laterally in posterior half forming transverse row. Dorsal locomotory ampullae developed on first six tergites. Tergite VII smooth, with long lateral setae on posterior margin. First-instar larvae distinguished by elongate body, head produced anteriorly, relatively long thoracic legs, and long lateral hairs on abdomen.

Material: Collected in Kunashir. Adult insects 33, larvae seven, raised from eggs laid by beetles in the laboratory.

Distribution: Kunashir; Japan. I found them in forests near Alekhino.

Biology: Found in mountain forests in Kunashir. Beetles found on flowers, gathering pollen, and also on herbaceous cover. Gonads mature during feeding period. In 1974 en masse flight observed from July 12 through 20. Female lays eggs in bark crevices on coniferous species. Ovaries of one female (weight 15 mg) collected from a flower contained 25 eggs. Larvae hatch in 18 to 20 days of oviposition. Thus from eggs
203 laid on July 12 through 18, larvae began hatching from August 5th under natural conditions. Similar observations recorded at other times. Young larvae bore into bark, make galleries underneath it, and plug them with frass.

4. *Pidonia quercus* (Tsher.)

Cherepanov and Cherepanova, 1975, *Taksonomiya i ekologiya zhivotnykh Sibiri* (Nov. i maloizv. vidy fauny Sibiri, vol. 9), pp. 28-42 (*Pseudopidonia*).

Adult (Figure 114): Similar to *Pidonia gibbicollis* (Bless.) in body shape and color of elytra. Readily distinguished by small body size, long antennae, and other features. Body somewhat elongate, broader in female, notably narrower in male. Head elongate, directed forward, insignificantly bent downward, with dense punctation, and sharply produced behind temples; cervix narrow. Frons with short longitudinal suture, raised spinescently on inner side of antennae. Temples long, with notable posterior projection, sparse minute punctation. Eyes markedly convex, distinctly faceted, slightly emarginate on inner side, proximate to mandibles. Genae short. Antennae long, 10th or 11th segment reaches beyond apex of elytra in male but not necessarily so in female. Third antennal segment as long as 5th, much longer than 4th; 11th segment elongate, gently pointed apically, equal in length to 10th.

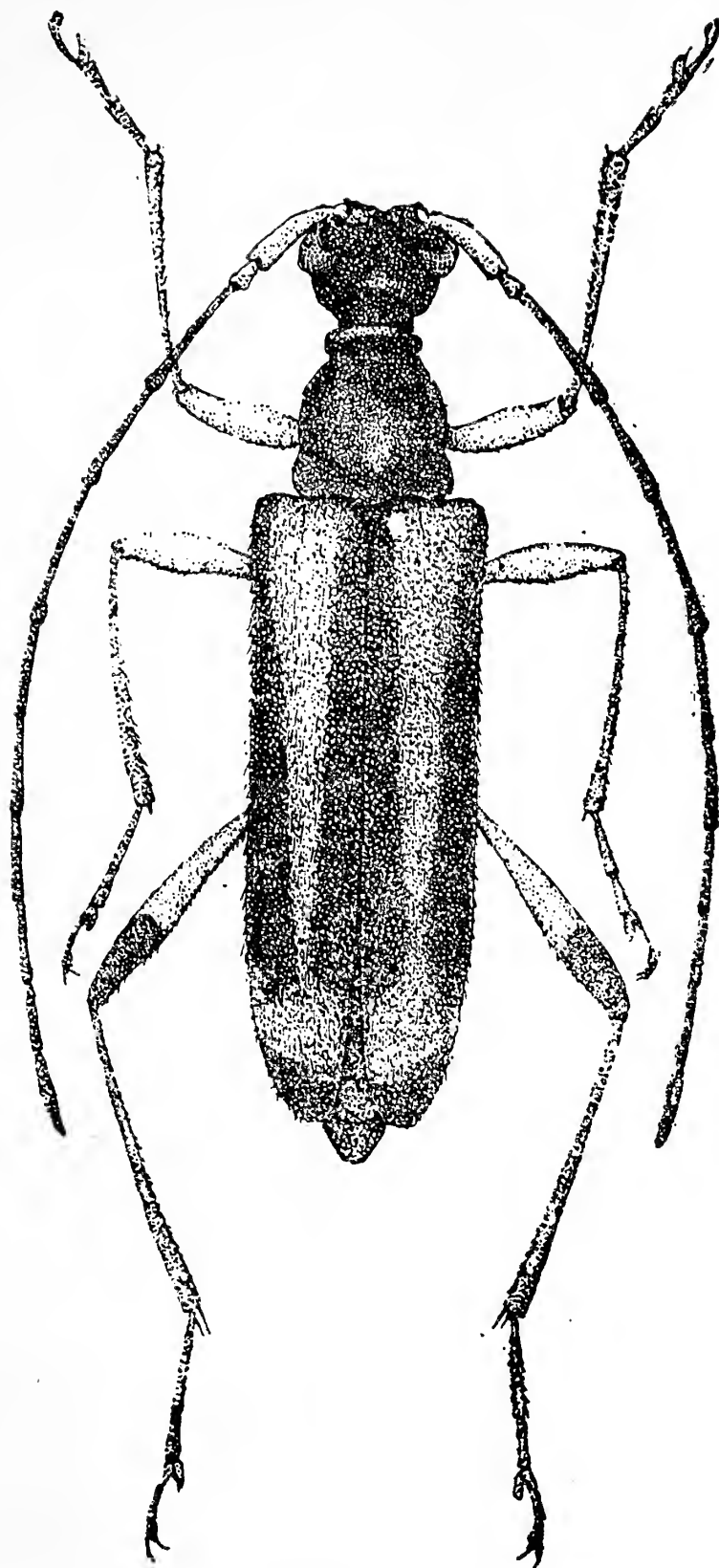


Figure 114. *Pidonia quercus* (Tsher.).

Pronotum markedly convex, with projecting tubercle medially anterior to base, narrows anteriorly, broadly rounded or angular laterally, with sharp flange anterior to apex, distinct transverse groove at base, with even dense punctation covered by minute, light-colored adherent hairs, and notably longer than width at base. Scutellum elongate, pointed or narrowly rounded posteriorly, with minute punctation. Elytra

with parallel sides, convex, notably broader than pronotum, with rounded humeri, dense deep punctation, and light-colored semi-adherent hairs, and broadly rounded apically. Legs long and slender. Hind tibiae not shorter than tarsi. First segment of hind tarsi equal to successive ones together.

- 204 Abdomen of female convex, broad, narrows posteriorly, with sternite V rounded terminally. Head, pronotum, meso- and metathorax, and major part of abdomen black. Antennae light rust; apices of segments commencing from 3rd blackened. Prosternum and abdominal sternites (on posterior margin or disk) often rusty-red, sometimes entire abdomen (in male) black. Elytra straw-yellow, with broad black band on suture and on sides reaching hind clivus, and black border apically. Ends of black bands at hind clivus sometimes broaden so much that they fuse at this site. Legs straw-yellow, claw-bearing segment and hind femora apically sometimes with dark brownish tinge. Length of body 6.0 to 9.0 mm.

Larva (Figure 115): Body moderately elongate. Head flat, gently rounded laterally. Epistoma triangular, laterally bound distinctly by frontal sutures (sutura frontalis) and medially divided by brownish longitudinal suture (sutura medialis). Hypostoma transverse, broadly emarginate posteriorly, bound laterally by somewhat curved sutures; medially with faint longitudinal white stripe. Ocelli on anterolateral margin of parietals resemble three adjacent pigmented granules, visible under high

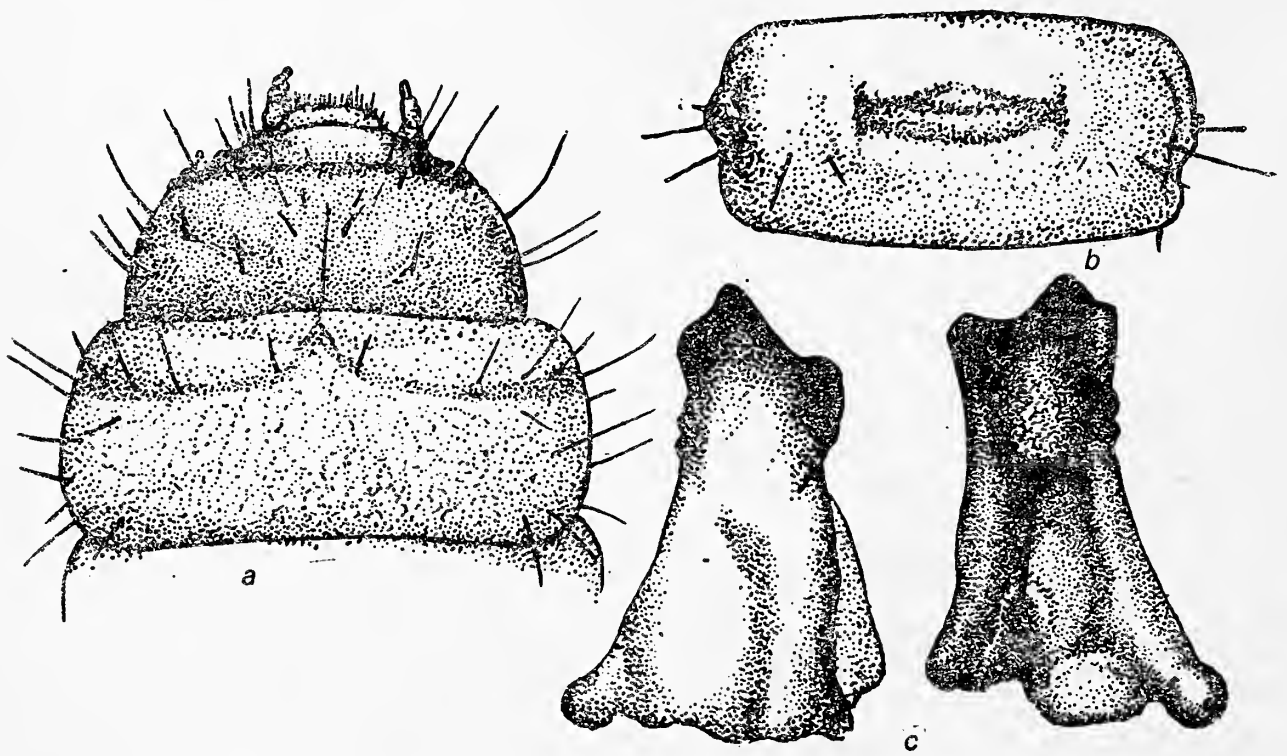


Figure 115. Larva of *Pidonia quercus* (Tsher.).

a—head and pronotum; b—abdominal tergite with locomotory ampulla; c—right mandible, inner and outer view.

magnification, and form transverse band. Clypeus broad and trapezoidal, with rounded anterior angles. Labrum narrows gently toward base, broadly rounded anteriorly, with sparse long setae. Mandibles long, elongate, obliquely notched apically, with distinct subapical denticle on underside and hence appear (anterior view) apically trifid, with middle denticle longest. With time, apical denticles wear down.

Pronotum bulges slightly, transverse, insignificantly narrows anteriorly and posteriorly, with sparse hairs widely separated in anterior half in region of transverse yellow band forming transverse row. Pronotal shield bulges slightly, not demarcated laterally; longitudinal folds lacking. Thoracic legs well developed, long and slender; claws minute, dark brown.

205 Abdomen elongate, with stray long hairs laterally. Dorsal locomotory ampullae slightly convex, developed on six tergites and divided by two indistinct transverse grooves. Body white. Head yellowish-rust, mandibles dark brown. Anterior half of pronotum with narrow transverse rusty or yellowish band interrupted medially by narrow white clearance. Length of mature larvae 9.0 to 11.0 mm.

Pupa (Figure 116): Body elongate, curves ventrally. Head comparatively produced, bent under. Frons elongate, bulges slightly; widely separated setae around antennal bases form longitudinal row. Antennae bend around midfemora, curve ventrad, annular.

Pronotum slopes markedly toward head, with 16 long setae at base forming dense transverse row interrupted medially, with tubercularly raised disk and long setae here. Legs long and slender; femora with thin piliform setae apically, markedly directed dorsally.

Abdomen slender, markedly narrows posteriorly. Posterior half of abdominal tergites with sparse piliform setae. Tergite IX produced, spinose, terminally pointed. Tip of abdomen (ventral view) obtuse, bound by horseshoe-shaped or triangular carina covered with dense long hairs. Valvifers of female well developed, hemispherical, often slightly produced.

Material: Collected in Ussuri-Primor'e region. Adult insects 10, larvae 36, pupae nine, larval exuviae with beetles from cells four.

Distribution: Ussuri-Primor'e region within oak forests.

Biology: Inhabits oak forests with a density of 0.5 to 0.8. Flight of beetles occurs in June. Beetles usually not seen on flowers. Female lays eggs on bark of viable oak. Trunks 16 to 40 cm in diameter and up to 5.0 to 7.0 m in height colonized. Larvae live in cork layer of bark, make longitudinal meandering galleries, and plug them with frass. Width of gallery toward end of larval life in bark up to 5.0 to 6.0 mm. In autumn larvae of first, possibly second year, abandon bark, burrow into soil, and overwinter there. In early spring they make oval pupal cell in soil

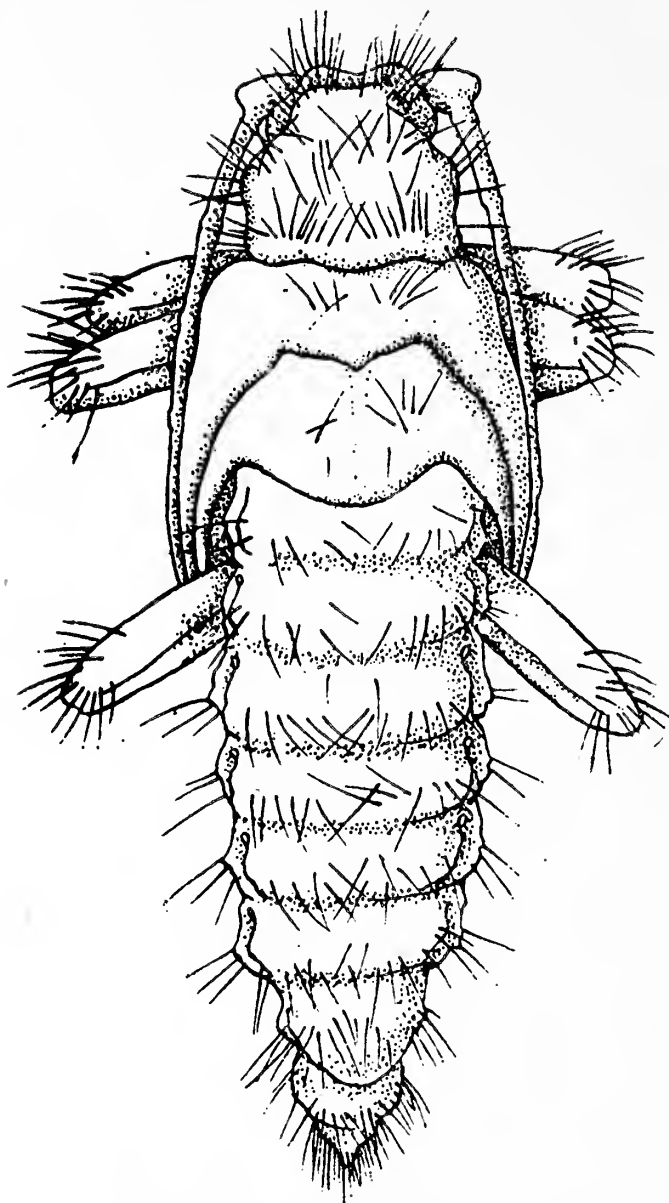


Figure 116. Pupa of *Pidonius quercus* (Tsher.).

at a depth of 1.0 to 5.0 cm and pupate in it. Inner wall of cell well polished. Length of cell up to 8.0 mm, width about 6.0 mm. Cells made in a radius of up to 20 cm from trunk, but sometimes close to basal zone.

206 Pupae seen up to June. Beetles sighted in last few days of May. Their emergence from soil ceases in first 10 days of June. Soil temperature during larval and pupal development rises to 8.0 to 10.0°C. Weight of larvae before prepupae 17.0 to 27.6 mg, pupae 14 to 23 mg, young beetles before emergence from cells 8.0 to 15.2 mg.

Larval density in oak bark comparatively high. Bark at infestation sites considerably thinner than in sections not colonized by larvae. Bark layer adjoining bast often damaged. It is difficult to ascertain whether this has an adverse influence on the physiological state of the tree. This problem requires special study.

9. *Pidonia similis* (Kr.)

Kraatz, 1879, *Deutsch. Entom.*, vol. 23, p. 102 (*Grammoptera*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 244-245 (*Pseudopidonia*); Gressit, 1951, *Longicorn Beetles of China*, vol. 2, p. 74; Hayashi, 1969, *Bull. Osaka J. Women's Jr. College*, vol. 4, pp. 84-85; Cherepanov and Cherepanova, 1975, *Zhuki-drovoseki ivovykh lesov Sibiri*, pp. 40-44 (*Pseudopidonia*).

Adult (Figure 117): Beetles readily distinguished by black spots on sides of red pronotum. Body of female comparatively thick, of male elongate. Head narrows distinctly behind temples. Frons bulges markedly and produced at base of antennae, with deep median longitudinal suture. Eyes large, with slight emargination on inner side in upper half.

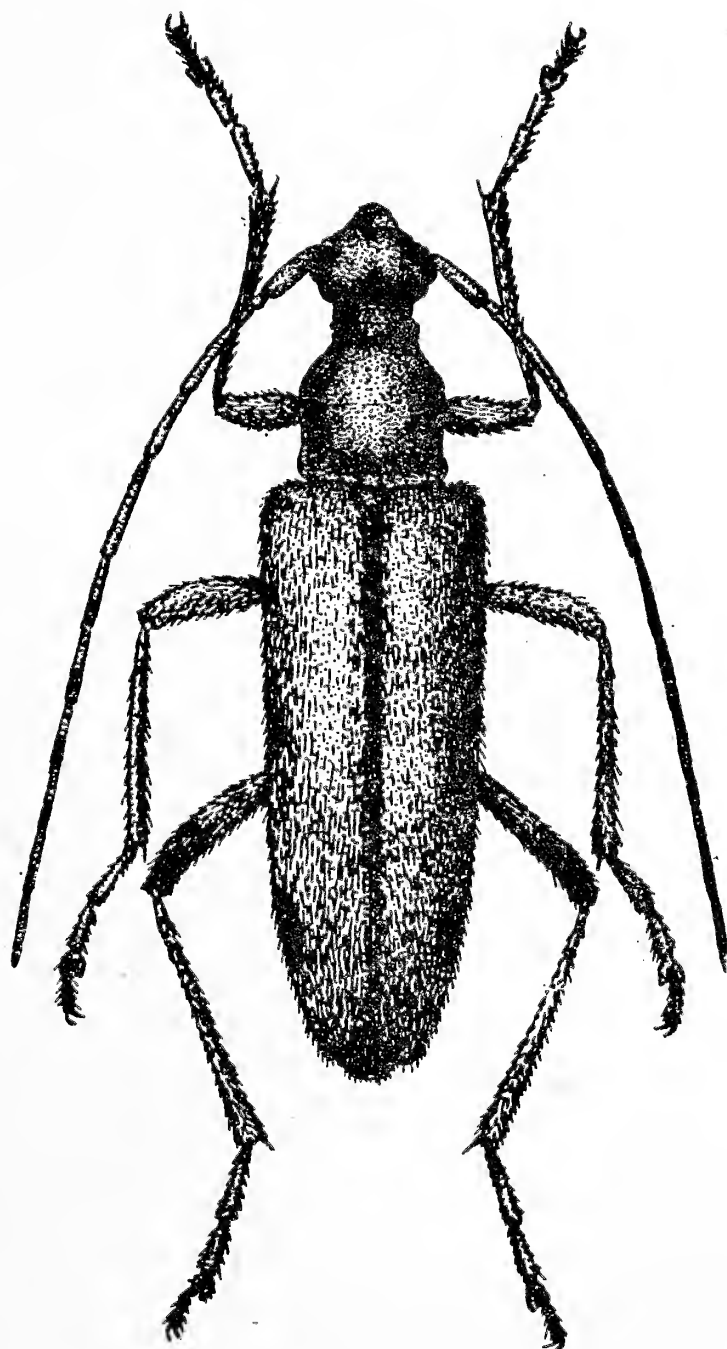


Figure 117. *Pidonia similis* (Kr.).

Tenth antennal segment reaches beyond apex of elytra in male but not in female.

Pronotum markedly narrows anteriorly, with broad transverse flange on anterior margin, less distinct flange at base, and bulges, dome-like on disk; with distinct dense punctation and yellow adherent hairs directed backward. Scutellum triangular, slightly pointed apically, with minute punctation. Legs long; femora slightly dilated, tibiae thin, hind tarsi almost half as long as tibiae.

Elytra elongate and convex, narrow more in male, less in female from humeri to apex, and apically obtuse; with dense punctation in anterior half (especially at base), minute punctation in posterior half (toward apex), and yellow semiadherent hairs. Body light rust. Antennae rusty, blackened apically on 5th to 10th segments. Pronotum reddish or rusty, laterally with longitudinal black spot. Legs light rust with yellowish tinge; hind femora blackened apically. Elytra light rust, with black band on suture, two or three longitudinal diffuse spots laterally. Length of body 11 to 13 mm.

Egg: White, turning green in due course; elongate, with parallel sides, obtusely rounded at one pole, papilliform at the other. Chorion with dense cells and thin silvery septa between them. Length 1.5 mm, width 0.4 mm.

Larva (Figure 118): Body elongate, narrows gradually toward apex. Head transverse, slightly retracted into prothorax, narrowly rounded anteriorly. Epistoma triangular, medially divided by dark brown longitudinal suture (sutura medialis), distinctly bound by whitish frontal sutures laterally, with indistinct white transverse band in anterior half. Hypostoma with median longitudinal white band, narrows somewhat anteriorly, with pair of widely separated setaceous hairs in anterior half. Antennal bases laterally with three darkly pigmented ocelli, distinctly separated but adjacent, forming short band. Clypeus broad, flattened, smooth. Labrum broad, with short setae on anterior margin. Mandibles elongate, slightly flattened on outer side in anterior half, with median transverse carinate prominence; with three denticles at apex, of which two lower ones proximate, upper one shifted toward base. Prosternum almost glabrous, with six widely separated setaceous hairs on anterior margin forming transverse row, pair of adjacent hairs at apex of eusternum, and pair of minute hairs in middle, shifted laterally.

Pronotum transverse, length 0.33 width, flat, slightly broadens anteriorly; with fine sinuous striation; two short hairs in middle of anterior half (closer to apex), three to four long hairs forming transverse row laterally, and three short hairs forming second transverse row mediolaterally. Pronotal shield flat, small, not demarcated laterally (longitudinal lateral folds absent), shagreen, with two widely separated setae at base.

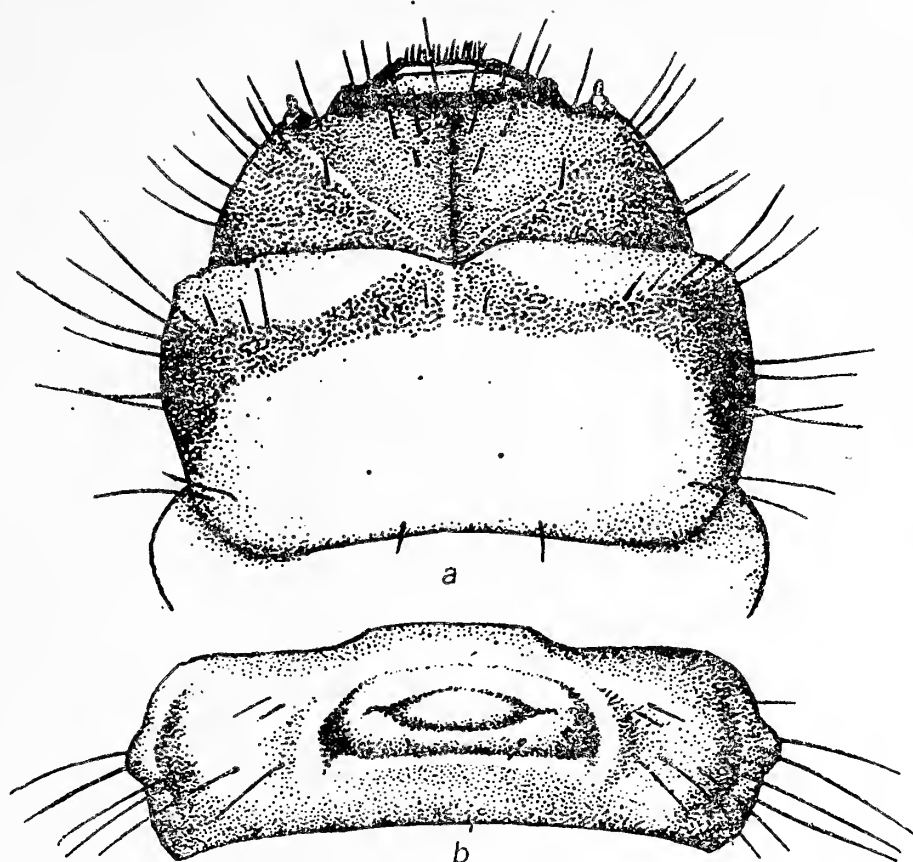


Figure 118. Larva of *Pidonia similis* (Kr.).

a—head and pronotum; b—abdominal tergite with locomotory ampulla.

208 Legs long; claws thin, slightly curved, with long seta on inner side at base.

Abdomen elongate. Dorsal locomotory ampullae convex, shagreen; divided by three transverse deep grooves, of which two posterior ones almost parallel, laterally join short longitudinal folds, while anterior groove curved, short, and laterally joins second transverse groove. As a result, two carinae form, bound by transverse grooves: anterior one with pointed and posterior obtuse ends along sides. Ventral locomotory ampullae shagreen, divided by transverse groove that joins short longitudinal folds. Body white. Head dark, anterior margin brownish-rust, mandibles reddish-rust, darkened apically. Pronotum with transverse yellow band on anterior margin that broadens on disk, and with yellowish sides. Body length of mature larva 18 to 23 mm, width of head 3.0 to 3.5 mm.

Pupa (Figure 119): Body moderately elongate. Head bent under. Frons at base of antennae on inner side and along sides of vertex (behind antennal bases) with long piliform setae. Antennae bend around midfemora, curve ventrad, annular.

Pronotum bulges, considerably narrower apically than basally, transversely impressed (with distinct flanges) on anterior and posterior margins; with dense long coarse adherent setae forming continuous

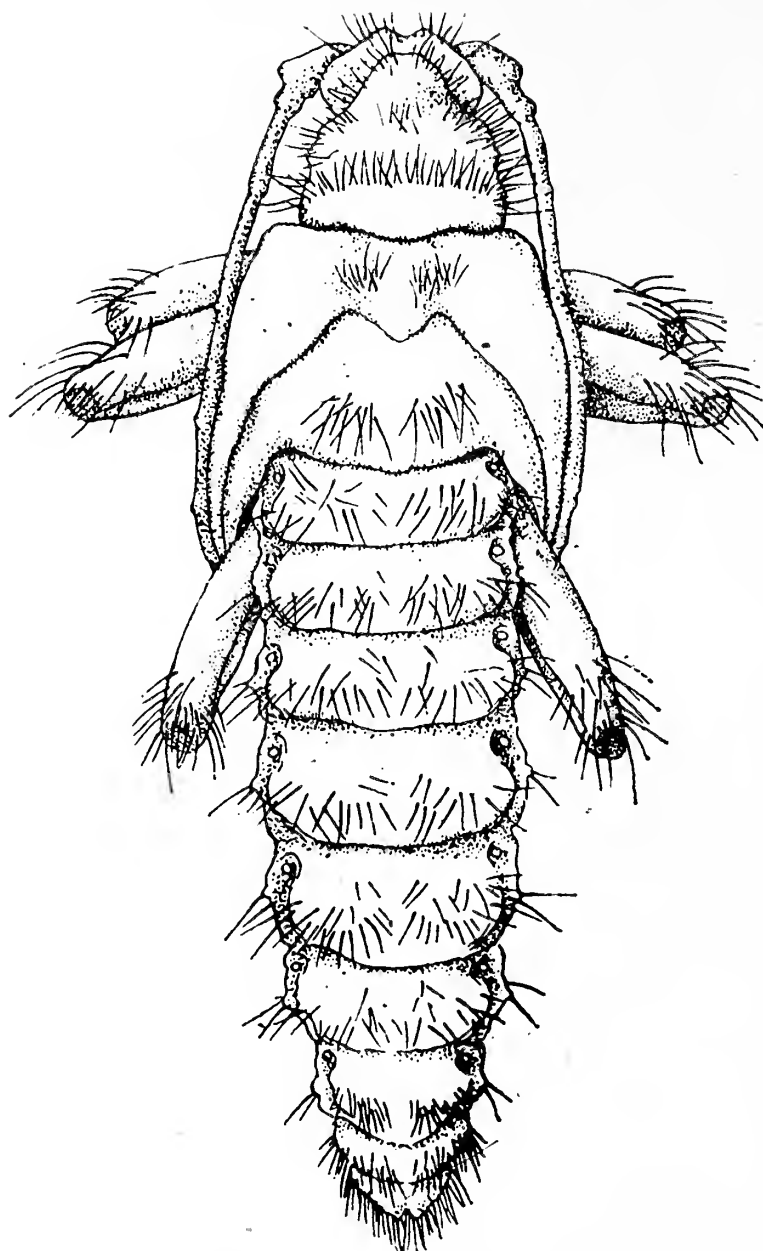


Figure 119. Pupa of *Pidonia similis* (Kr.).

transverse row at base, thin setae forming two transverse bands in middle and at apex. Meso- and metanota with dense piliform setae.

Abdomen narrows posteriorly from 3rd segment; somewhat bent under. Abdominal tergites convex, with long piliform setae behind middle. Tergite IX with long hairs and two small light-colored (non-sclerotized) spinules at tip. Tip of abdomen (ventral view) bound by densely pubescent horseshoe-shaped carina. Valvifers of female conical, small but distinct. Length of body 11 to 15 mm, width of abdomen 3.5 to 4.0 mm.

Material: Collected in Ussuri-Primor'e region. Adult insects 34, larvae 11, pupae eight, larval exuviae from cells with beetles nine.

Distribution: Ussuri-Primor'e region; North Korea, possibly northern China. Mainly found in catchment areas of Komarovka and Artemovka Rivers.

209 *Biology*: Mainly inhabits low-lying deciduous forests. Associated more with willow and bird-cherry. Flight of beetles in June, maximum in July. Often seen on flowers of Umbelliferae, Rosaceae, and other plants. Female lays eggs in soil, on roots of willow and bird-cherry. Incubation period of eggs at $16.8 \pm 0.7^{\circ}\text{C}$ lasts for 14 to 19 days. Larvae hatched from July 18 to 25 from eggs laid by beetles in a garden under a forest canopy from June 30 to July 7th.

Larvae live in bark and under root bark; often found on bark or away from roots (during prepupal period). They hibernate at least twice. Before pupation larvae make spherical pupal cells in soil up to a depth of 5.0 cm near roots. Length of pupal cells 11 to 15 mm, width about 8.0 to 10.0 mm. Most of the larval population pupates on the southern side of trees. Thus on June 11, in soil around a stump of bird-cherry 20 cm in diameter, seven pupae were found on the southern side and none on the northern. Similar observations have been made at other times. Soil temperature during pupation 8.0 to 12.0°C .

Pupation occurs in May, ceases mid-June. During excavations in 1973, on May 31 in the catchment area of Komarovka River three larvae and 23 pupae were found, but on June 9th only adults and pupae and no mature larvae. Pupae maximum in last few days of May and early June. Pupa lies horizontal in cell with dorsal side up. Adults sighted around June 5th. Young beetles remain in cells for not more than one week, break the cell wall, and emerge on soil surface. Toward the end of second 10 days of June emergence of young beetles from soil ceases. They require supplementary feeding and gather pollen from flowers. Weight of larvae before pupation 47.3 to 121.0 mg, pupae 37.5 to 104.0 mg, and beetles during period of emergence from soil 20.5 to 83.0 mg.

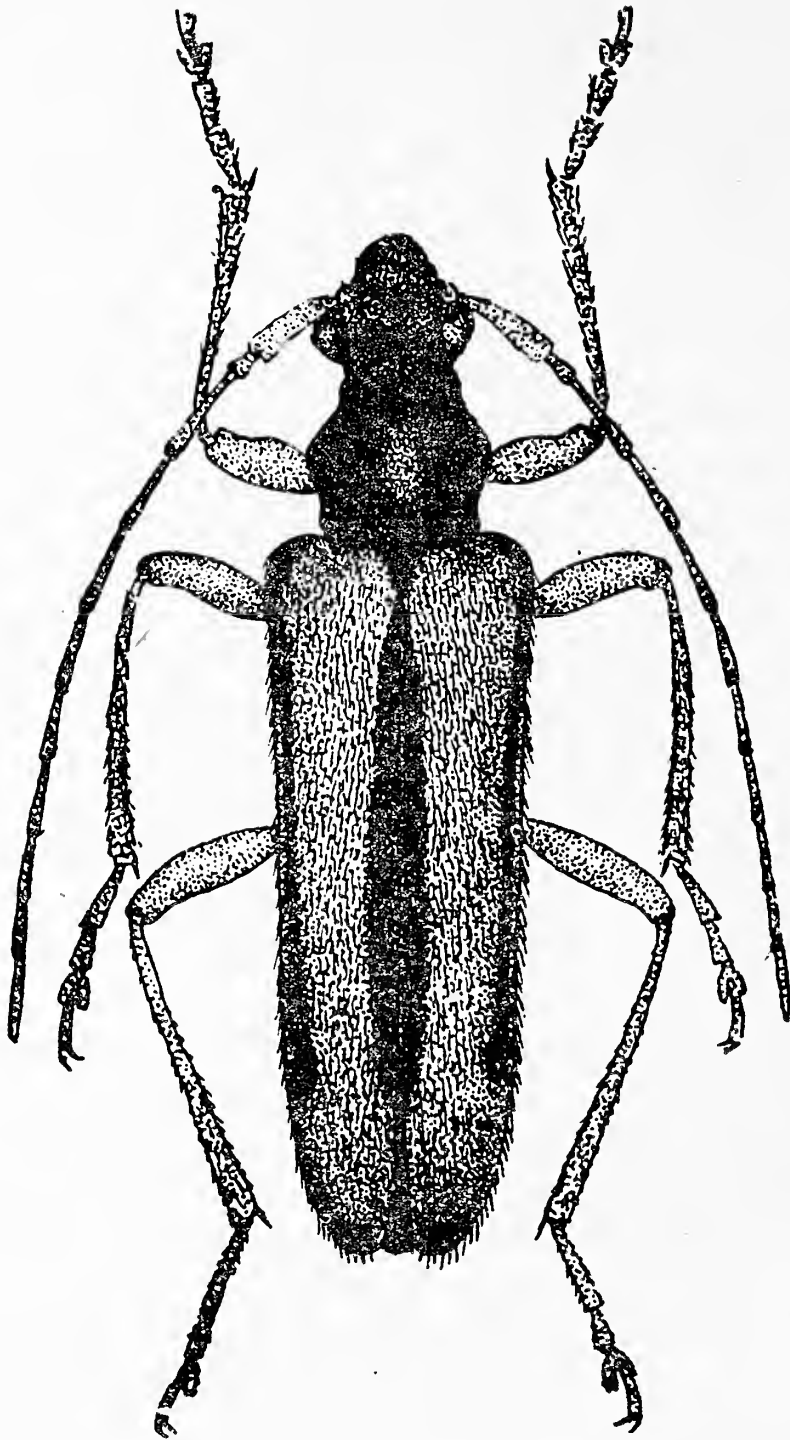
Pidonia similis (Kr.) colonizes roots of stumps and dead trees, and is not found on roots of viable trees. *Stenocorus ussuriensis* (Kr.) and *Pidonia amurensis* (Pic) found together with this species.

6. *Pidonia gibbicollis* (Bless.)

Blessig, 1873, *Hor. Soc. Entom. Ross.*, vol. 9, p. 258 (*Leptura*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 246-248 (*Pseudopidonia*); Gressitt, 1951, *Longicorn Beetles of China*, vol. 2, p. 73; Hayashi, 1969, *Bull. Osaka J. Women's Jr. College*, vol. 4, pp. 80-81.

Adult (Figure 120): Differs from other species of this genus in very large body. Head with flat dense punctation, thin septa between punctation, sparse, barely perceptible adherent hairs, transverse prominences between antennae, and rounded temples. Antennae thin, usually shorter than body (female) or barely reach apex of elytra (male).

Pronotum somewhat longer than width at base, bulges (cowl-shaped)

Figure 120. *Pidonia gibbicollis* (Bless.).

in posterior half, angularly broadens mediolaterally, narrows anteriorly, less so posteriorly; with dense round deep punctation, and minute adherent hairs directed backward. Scutellum short, broad, triangular, with indistinct punctation.

Elytra convex, more or less elongate, with projecting humeri, narrows somewhat posteriorly, with almost parallel sides, obtuse apically, with rounded angles; with large deep punctation in anterior third, more obliterated punctation on hind clivus, and semiadherent hairs. Legs long and slender; hind femora do not reach apex of elytra. Hind tarsi notably shorter than tibiae. Body black. Antennae rusty, apical seg-

ments darkened, but in some specimens entirely dark brown from 5th segment toward apex. Legs light rust; femora on upper side sometimes darkened. Elytra straw-yellow, with longitudinal black stripe on sides from humeral tubercle to hind clivus (sometimes interrupted at one or two places); usually broaden toward apex; with blackened suture. Length of body 9.0 to 12.0 mm.

Egg: White, acquires greenish tinge in course of time, elongate, narrows toward poles, rounded at one end, pointed at the other; with distinct cellular sculpture and narrow septa between cells. Length 1.5 mm, width 0.5 mm.

Larva (Figure 121): Differs from larvae of other species in fused oval ocelli and four long setae on posterior margin of sternite IX. Head slightly retracted into prothorax, narrowly rounded anteriorly. Epistoma flat, somewhat impressed along longitudinal suture, with short paired setae anterior and posterior to middle, slightly shifted anteriorly in posterior half, not forming common regular transverse row with lateral setae. Posterior parietal setae in region of white frontal sutures (sutura frontalis). Hypostoma trapezoidal, distinctly narrows anteriorly, with median longitudinal stripe, one large seta laterally on each side anterior to middle. Ocelli fuse, transversely oval, in form of continuous black spot. Clypeus broad, short. Labrum gently rounded anteriorly, transverse, smooth, lustrous, with pair of widely separated setae at base, and short setae on anterior margin.

Pronotum transverse, flat, with yellow transverse band on anterior margin, and stray setaceous hairs forming transverse row. Eusternum with single pair of setae, without additional seta between them. Thoracic legs well developed; claws very small, thin, acicular, moderately sclerotized; inner side of femora with four coarse setae. Dorsal locomotory ampullae consist of two transverse carinae, without setae or with indistinct stray setae. Abdominal sternite IX on posterior margin with four long setaceous hairs. Anal lobes smooth, with one long lateral seta on each side at apex, two each basally; sometimes with additional short setae. Length of body up to 15 mm, width of head 2.5 mm.

Material: Collected in Ussuri-Primor'e region (Komarovka and Artemovka Rivers and Ovchinnikovo village). Adult insects over 50, larvae 13 (developed from eggs laid by beetles in the laboratory).

Distribution: Amur. Ussuri-Primor'e region; northeast China, Korea, and Japan.

Biology: Ecologically associated with broad-leaved vegetation. Beetles seen in June, maximum in first half of July on flowers of Rosaceae, Umbelliferae, and other plants. Maximum activity of beetles from 10:00 a.m. to 4:00 p.m. Beetles mate as gonads mature and females then oviposit. Eggs laid in the laboratory on bark of roots and in soil

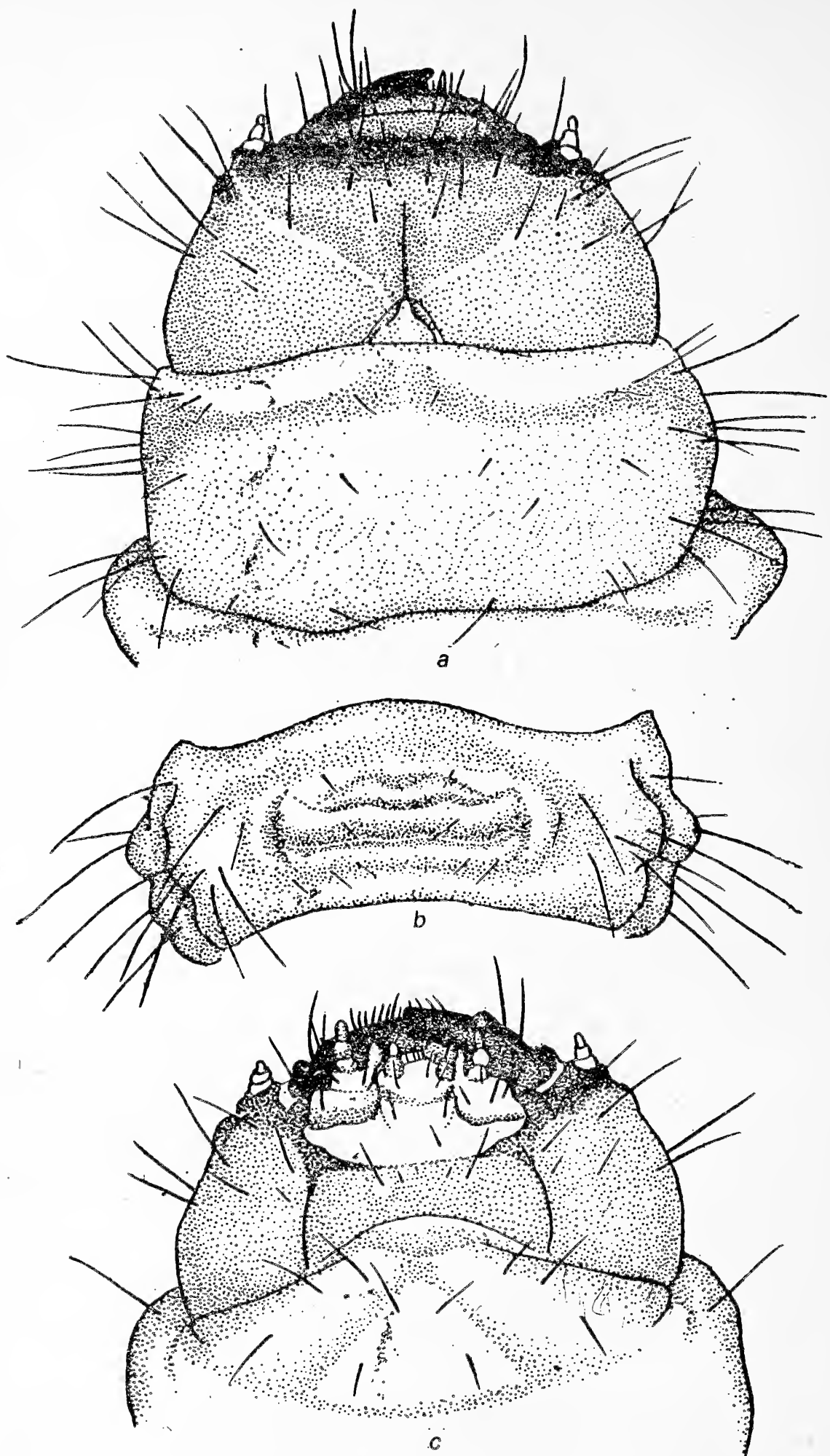


Figure 121. Larva of *Pidonia gibbicollis* (Bless.).
a—head and pronotum; b—abdominal tergite with locomotory ampulla;
c—head (ventral view).

around roots of willow and ash. Incubation period of eggs continues for up to two weeks. Larvae began to hatch from eggs laid June 6th to 10th in a garden under natural conditions on June 20. Larvae on hatching bore into bark, make galleries, and plug them with frass.

7. *Pidonia amurensis* (Pic)

Pic, 1900, *Echange*, vol. 16, p. 81 (*Pseudopidonia*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 248, 250, 242-244 [sic] (*Pseudopidonia amurensis* Pic); Gressit, 1951, *Longicorn Beetles of China* (*Pidonia amurensis* Pic); Hayashi, 1968, *Bull. Osaka J. Women's Jr. College*, vol. 3, pp. 35-51 (*P. amurensis* Pic); Cherepanov and Cherepanova, 1975, *Zhuki-drovoseki ivovykh lesov Sibiri*, pp. 44-48 (*Pseudopidonia*).

Adult (Figure 122): Beetles characterized by sharp sexual dimorphism. Male very slender, female thicker. Head behind eyes with sharp constriction. Frons between antennae with longitudinal groove and dense punctation. Eyes large, angularly emarginate insignificantly on

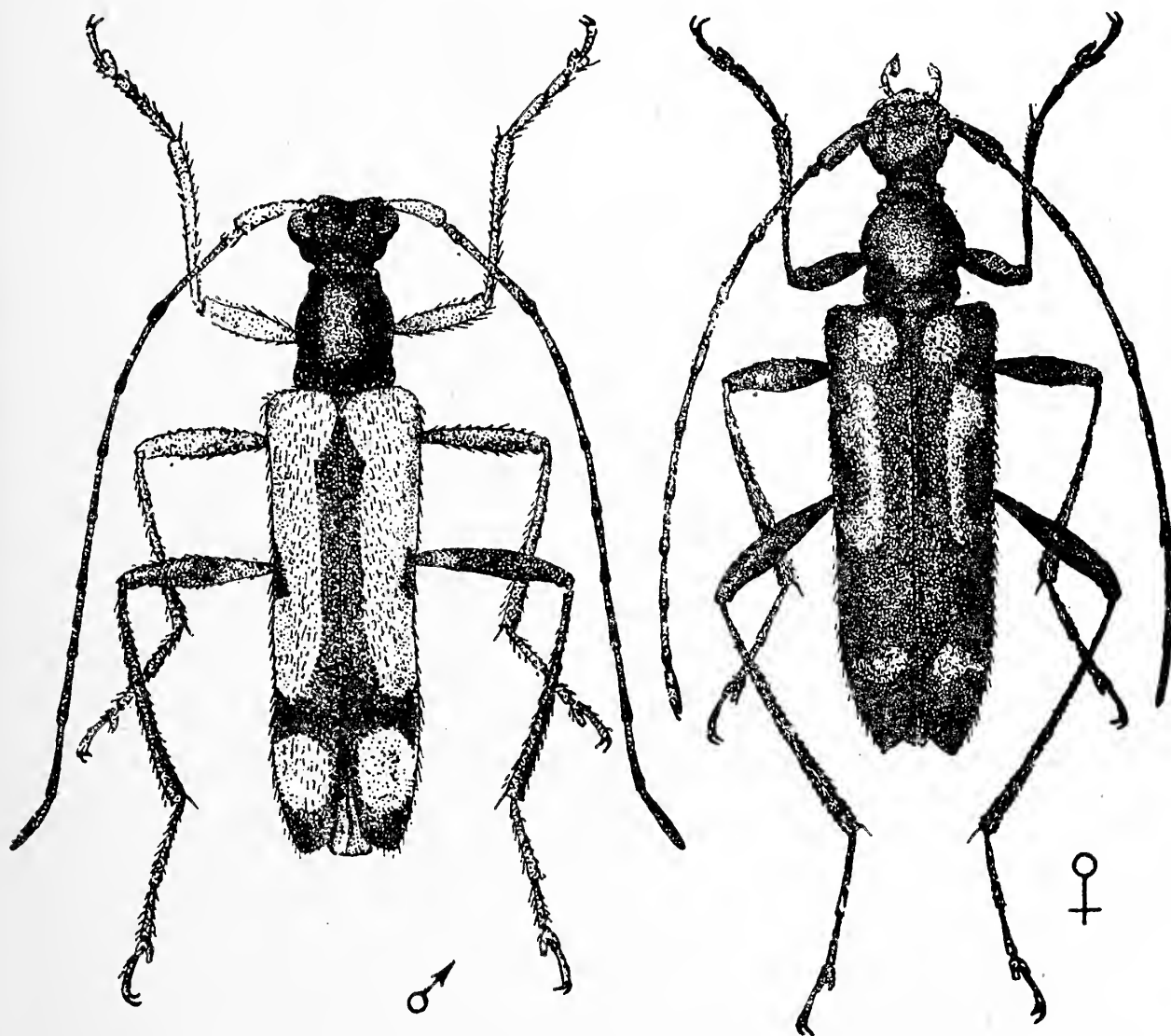


Figure 122. *Pidonia amurensis* (Pic).

inner side. Antennae long and thin, with 10th segment reaching beyond apex of elytra in male, only beyond 0.75 length of elytra in female.

213 Pronotum somewhat longer than width at base, tubercularly convex on disk, narrows anteriorly; posteriorly with small, anteriorly sharp transverse flange; with dense minute punctation and dense tender golden adherent hairs. Scutellum elongate, somewhat pointed or narrowly rounded apically. Legs long and slender. First segment of hind tarsi longer than successive ones or equal to them.

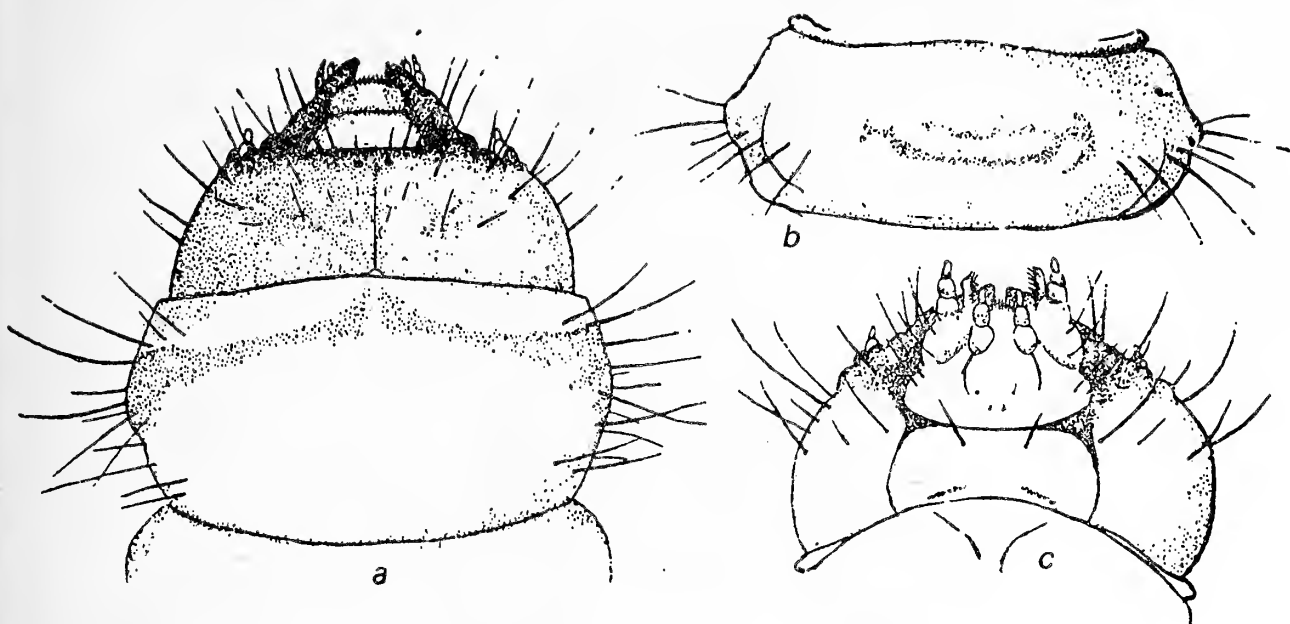
Elytra parallel, more elongate in male, notably broaden in female; obtusely rounded individually at apex; with deep punctation and semi-adherent yellowish-golden hairs. Body black. Elytra in male light straw-yellow, with broad black longitudinal band on suture joining transverse band in posterior third; short spot mediolaterally, long humeral spot at base. Elytra in female black, with yellow or rusty spots, of which one round spot basally at scutellum (often absent), second spot semi-circular at middle opens outward (as though consisting of two spots joined at suture by longitudinal curved band), and third transversely elongate spot on posterior quarter of disk. Sometimes dark color of elytra so extensive that yellow spots look like specks. Legs in male light rust, hind femora black, light colored basally; hind tibiae brownish. Legs in female black, rusty only at base of femora. Length of body 6.0 to 10.0 mm.

My observations in nature and in the laboratory revealed that the beetles earlier described as *Pseudopidonia amurensis* Pic, 1900 on the basis of elytral pattern pertained to females of this species. These specimens should be classified as variants reflecting sexual dimorphism.

Egg: Elongate, pointed at poles, matte white with greenish tinge. Chorion with distinct longitudinally elongate cells and broad coarse septa between them. Length 1.2 mm, width 0.4 to 0.5 mm.

Larvae (Figure 123): Body elongate, flat, with long thin lateral hairs. Head transverse, rounded laterally. Epistoma pointed apically, bound by straight frontal sutures, medially divided by brown longitudinal suture (sutura medialis) which is distinct in posterior half. Hypostoma entire, not divided medially, slightly convex, narrows somewhat anteriorly, with pair of widely separated setae in anterior half. Ocelli at base of antennae fuse into common round pigmented spot. Clypeus broad, trapezoidal. Labrum transversely oval, with long setae on anterior margin. 214 Mandibles elongate, obliquely truncate or somewhat notched apically, appearing trifid at apex in freshly molted larvae.

Pronotum 2.0 times wider than long, somewhat flat and finely striate on disk, with long sparse setaceous hairs on anterior margin forming transverse row laterally. Pronotal shield indistinct, almost not demar-



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Figure 123. Larva of *Pidonia amurensis* (Pic).

a—head and pronotum; b—abdominal tergite with locomotory ampulla;
c—head (ventral view).

cated laterally, since lateral longitudinal folds lacking. Prosternum divided by deep transverse fold directed backward. Thoracic legs well developed, comparatively long, with thin acute claws.

Abdomen somewhat flat, narrows insignificantly toward tip. Abdominal segments laterally produced, bulge slightly on disk. Dorsal locomotory ampullae divided by transverse grooves forming small carina anteriorly, and much larger one posteriorly; latter suspended in lateral longitudinal folds. Ventral locomotory ampullae divided by transverse groove that joins with lateral longitudinal grooves, and is somewhat outcurved. Body white. Head rusty, dark brown anterior margin of epistoma. Mandibles almost black. Anterior margin of pronotum with transverse yellow band that projects forward in middle. Length of body before pupation 11 to 12 mm.

Pupa (Figure 124): Body curves dorsally. Frons between antennae with broad longitudinal groove, sparse long hairs laterally. Apices of antennae extend around midfemora, turn forward, annular.

Pronotum bulges, dome shaped, with scattered long rusty hairs on disk and along sides, and thick setae on posterior margin forming dense transverse row. Meso- and metanota slightly convex, with sparse tender hairs. Legs long and slender; femora widely separated on sides and turn dorsally.

Abdomen markedly narrows posteriorly. Abdominal tergites convex, with sparse tender yellowish hairs in posterior half. Tip of abdomen flat, bound by semicircular horseshoe-shaped carina covered with tender yellowish hairs; two spinescent contiguous tubercles occur dorsally on

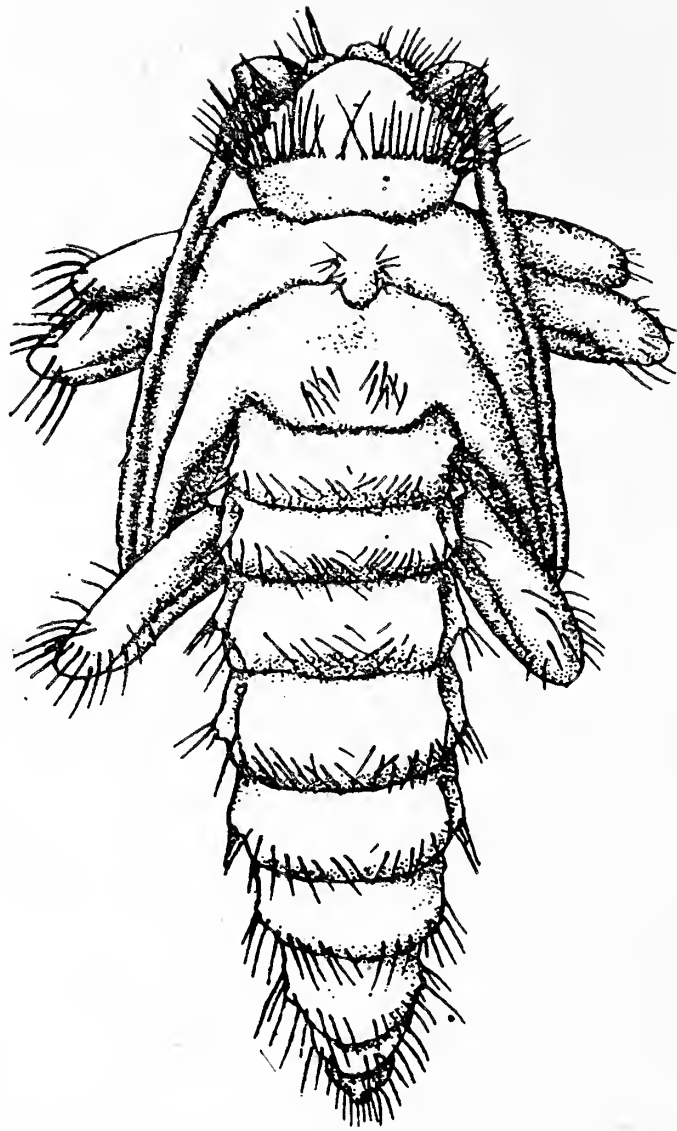


Figure 124. Pupa of *Pidonia amurensis* (Pic)
(from Cherepanov and Cherepanova, 1975).

carina. Valvifers of female indistinct, in form of hemispherical prominences located before anal pore. Length of body 9.0 to 11.0 mm.

Material: Collected in Ussuri-Primor'e region. Adult insects over 100, including 57 raised in the laboratory, larvae 47, pupae 56, larval exuviae with pupae from cells 32.

Distribution: Ussuri-Primor'e region; Japan, Korea. Highly numerous in catchment area of Komarovka River, around Zmeino hill near the V.L. Komarov sanctuary in Primor'e region.

215 *Biology:* *Pidonia amurensis* (Pic) inhabits deciduous and mixed forests. Flight of beetles observed in June and July. Beetles often seen on flowers of Umbelliferae, *Actinidia*, *Sorbaria sorbifolia*, and other plants; they gather pollen from them. Female lays eggs on bark (sometimes in bark crevices) and in soil around dead trees and on stumps. Mainly willow, Amur choke-cherry, rarely alder, aspen, and maple, and frequently fir colonized. At a temperature of $16.8^{\circ} \pm 0.7^{\circ}\text{C}$ larvae hatched in two to three weeks after oviposition. Thus from eggs laid on

June 15 to 23, larvae hatched on July 9th to 19th. Larvae ceased hatching in August.

Young larvae colonize bark of thick and thin roots and live in and under bark. Mature larvae make oval pupal cells in soil up to a depth of 3.0 to 5.0 cm. They lie horizontal and perform active rotatory movements, as a result of which the cell is widened and its walls tamped to a smooth and more compact surface. Larva pupates somewhat later. Length of cell 11 to 13 mm, width up to 8.0 mm. Pupal cells made around roots or at some distance from them, but not more than 15 cm away from tree. Pupa lies horizontal in cell, with dorsal side up. Maximum larvae pupate in soil on southern exposure of trees. For example, 14 larvae were found on the southern side of a willow stump (diameter 12 cm), but only four on the northern side.

Pupation occurs mainly in May and partly in early June. In 1973 in the catchment area of Komarovka River, of 100 larvae 89 had pupated by May 31. Beetles appear three weeks later. Pupae maximum in first few days of June. During the pupal stage soil temperature varies from 10 to 12°C. Emergence of beetles ceases in second half of June. Beetles maximum mid-June. Thus of 34 pupae collected from May 31 through June 6th, beetles emerged as follows: by June 6th—10, June 11 to 14—10, June 15 to 19—17, and June 20—one. Weight of pupae from 14 to 58 mg and adult insects 8.9 to 40.2 mg. Weight of insects developing on willow maximum, and developing on maple minimum.

Young beetles remain in cells for five to eight days, then break the upper wall of the cell and emerge onto soil surface. They mate soon after emergence from cells but require supplementary feeding. Female oviposits seven to eight days after first mating.

8. *Pidonia alticollis* (Kr.)

Kraatz, 1879, *Deutsch. Entom. Z.*, vol. 23, pp. 103–104 (*Grammoptera*); *tristicula*, Kraatz, 1879, *ibid.*, pp. 103–104; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 251–254 (+ *Pseudopidonia tristicula* Kr.); Gressitt, 1951, *Longicorn Beetles of China*, vol. 2, pp. 71–72; Hayashi, 1969, *Bull. Osaka J. Women's Jr. College*, vol. 4, pp. 71–73.

Adult (Figure 125): Characterized by pronotum with highly bulging, dome-shaped disk and sharp sexual dimorphism. Body elongate. Cervical region of head with sharp flange, posteriorly with adherent golden hairs from posterior margin of eyes to middle of occiput; with dense deep punctation. Antennae thin, reach apex of elytra in male, notably shorter in female. Eyes markedly convex, slightly emarginate.

Pronotum bulges markedly, dome shaped on disk, angularly broadens mediolaterally, markedly narrows anteriorly, with parallel sides in posterior half, somewhat curved anterior margin, bordered basally,

slightly emarginate at lateral angles, with minute punctation and adherent hairs directed backward and toward maximum prominence of disk. Scutellum triangular, pointed posteriorly, with dense punctation.

Elytra bulge, with parallel sides, more elongate in male, broaden
216 in female, with uniformly dense punctation and short semiadherent hairs; notably obtuse apically, with rounded angles. Legs slender; tarsi not longer than tibiae; 1st segment of hind tarsi distinctly longer than successive two. Body black. Prothorax red, scutellum black. Antennae light rust in male, dark brown in female. Elytra straw-rust with blackened suture (f. *typica*) in male, black or dark brown (= *tristicula* Kr.) in female. Length of body 7.0 to 8.5 mm. Specimens described earlier as *tristicula* Kr. represent only females of this species and may be treated as variants reflecting sexual dimorphism.

Egg: White with greenish-yellow tinge, narrows toward poles, narrowly rounded at ends; with dense but indistinct sculpture. Length 0.9 mm, width 0.4 mm.

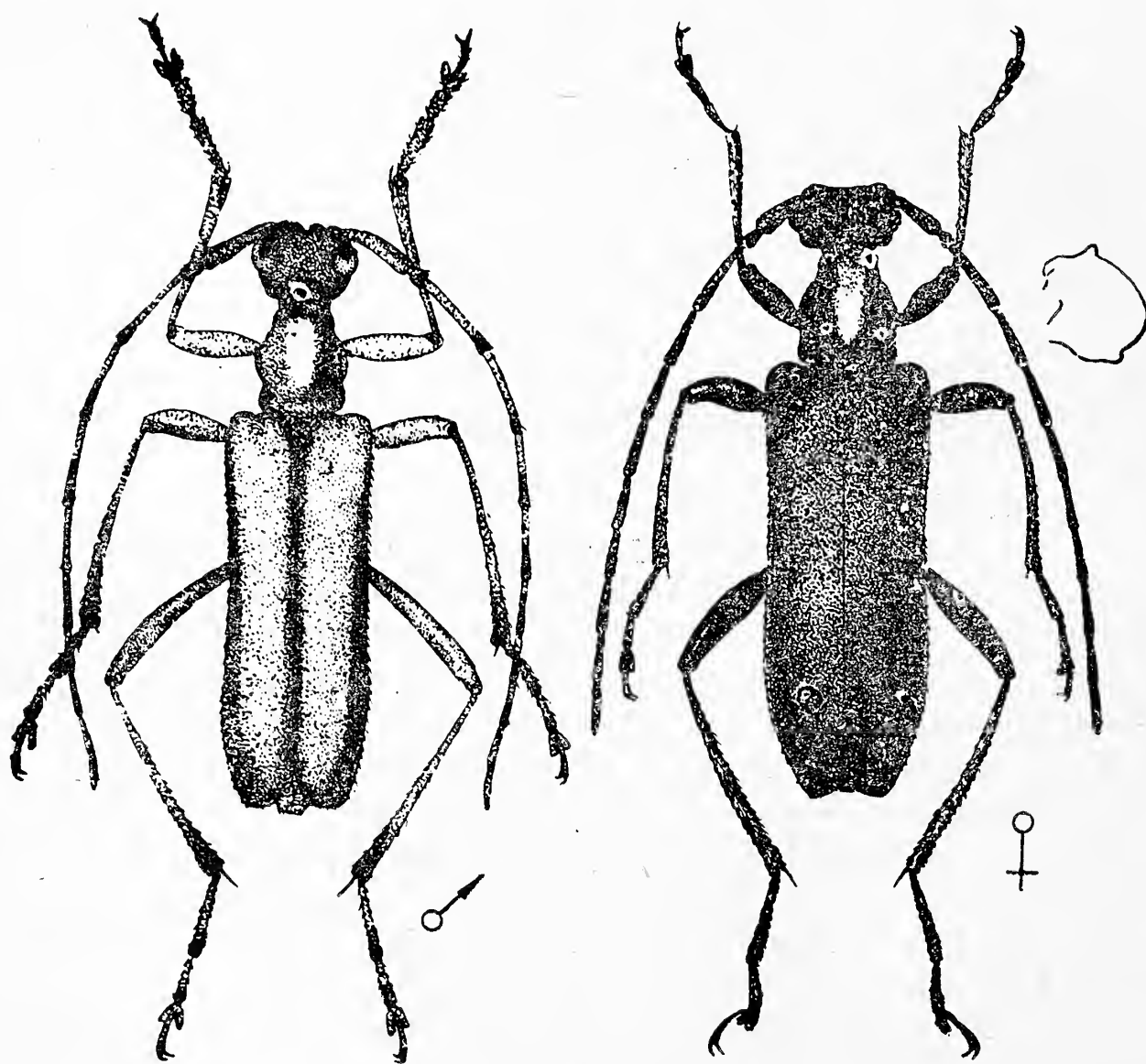


Figure 125. *Pidonia alticollis* (Kr.)

Larva (Figure 126): Body flat. Head flat, broadens laterally, narrows somewhat anteriorly. Epistoma (frontal plate) divided laterally by distinct white frontal sutures, in posterior half divided medially by longitudinal suture (*sutura medialis*). Four setae on epistoma anterior to middle form transverse row, two short indistinct setae in posterior half form common transverse row together with parietal setae and shifted toward frontal sutures. Hypostoma distinctly narrows anteriorly, with narrow white median longitudinal band; in anterior half with pair of lateral setae set away from white band. Parietals in anterior half with stray setaceous hairs. Ocelli highly fused, form short transverse band around antennal bases.

Pronotum broad, flat on disk; anterior margin with transverse yellow band and short stray setae forming transverse row; stray long hairs mediolaterally. Pronotal shield not demarcated from general sur-

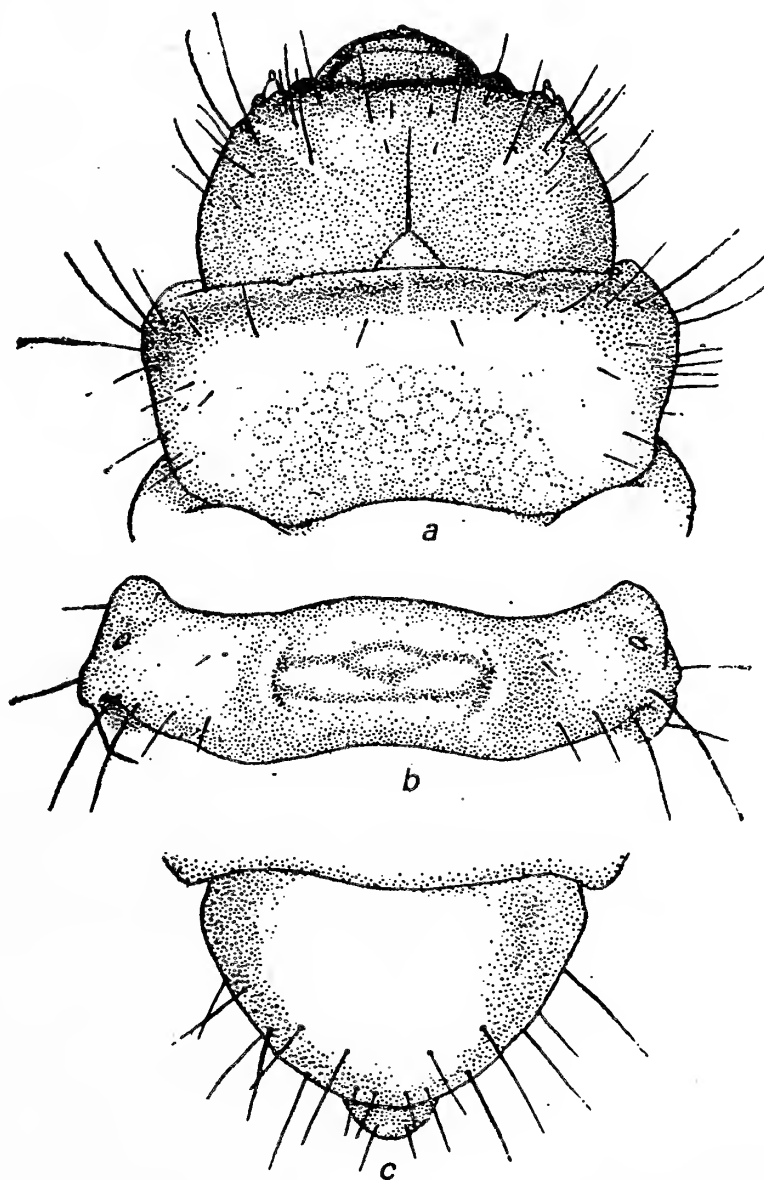


Figure 126. Larva of *Pidonia alticollis* (Kr.).

a—head and pronotum; b—abdominal tergite IV with locomotory ampulla; c—abdominal tergite IX.

face; lateral longitudinal grooves absent. Prosternum glabrous, with only stray setae or setaceous hairs. Eusternum near anterior margin with pair of widely separated coarse setae and short unpaired seta between them closer to apex. Thoracic legs well developed, with pointed, moderately sclerotized claw.

Abdomen broad, narrows somewhat posteriorly. Abdominal tergites bulge insignificantly; in posterior half with four lateral setae forming transverse row, of which two inner ones (closer to locomotory ampullae) short, lateral ones long. Dorsal locomotory ampullae, as in other species of this genus, occur on first six abdominal tergites and consist of two transverse carinae; posterior carina with only two indistinct short setae on each side, which are sometimes not visible. Posterior margin of sternite IX with four long setaceous hairs. Anal lobes basally with short stray hairs. Length of body 9.0 mm, width of head 1.8 mm.

218 *Pupa* (Figure 127): Body moderately elongate. Head markedly bent under, with long setae at base on inner side forming two tufts; occiput with tubercular prominences bearing tufts of long setae along sides of longitudinal groove. Antennae flexed to sides, bent ventrad, annular.

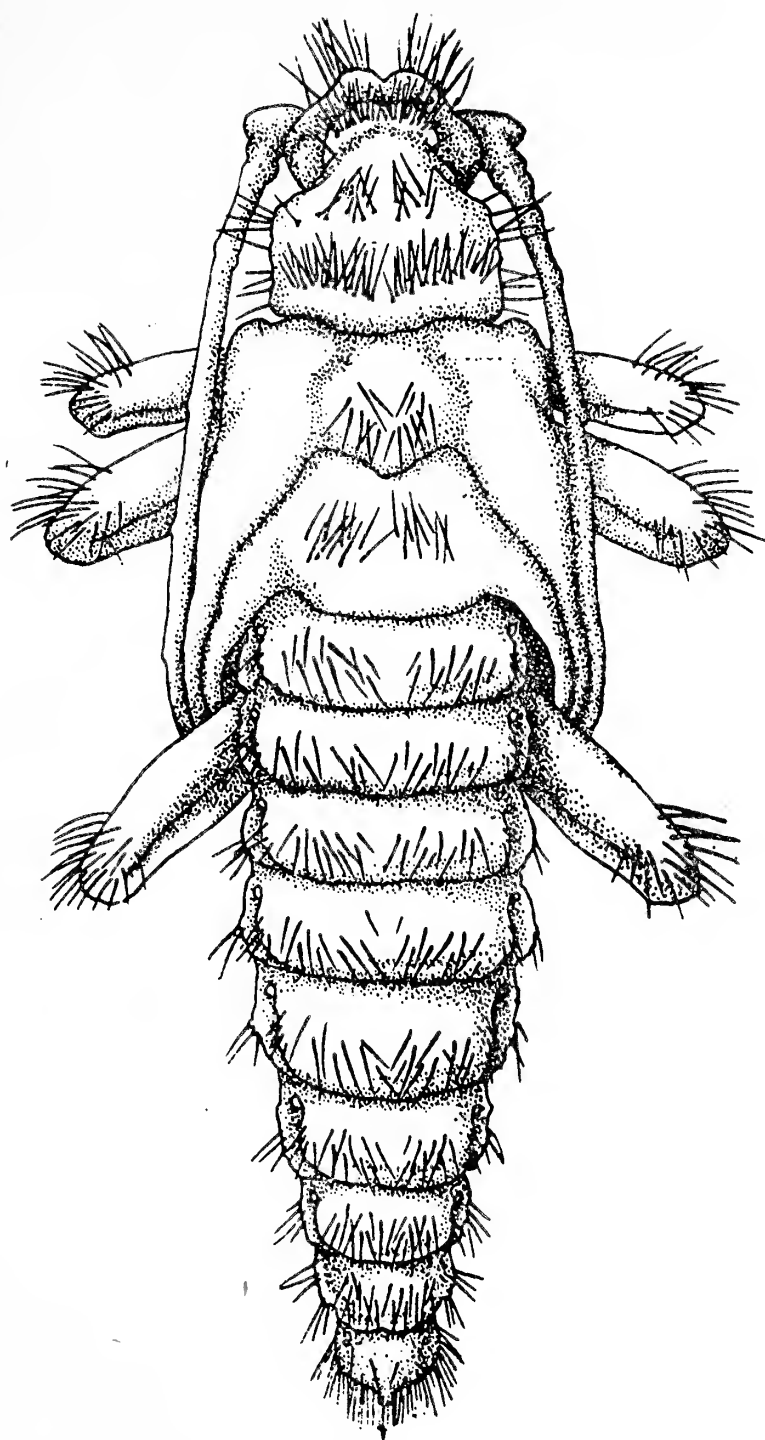
Pronotum convex, with parallel sides in posterior half, narrows markedly in anterior half; perceptible flange with bent margin at apex with long dense setae; basally with dense transverse, medially interrupted row of long coarse setae set on produced base (up to 38 to 40 setae); sparse long setae on disk and laterally. Meso- and metanota in posterior half with long setae forming almost continuous transverse field. Legs long, bent dorsally. Femoral apices dorsally with long dense setae.

Abdomen narrows from anterior to posterior end. Abdominal tergites in posterior half with long setae forming transverse band. Posterior margin of tergite IX with indistinct nonsclerotized spinule. Tip of abdomen (ventral view) obtuse, bound by horseshoe-shaped carina covered with thin dense setae. Length up to 9.0 mm.

Material: Collected in Ussuri-Primor'e region. Adult insects over 100, larvae four, pupae three, larval exuviae with beetles from cells three.

Distribution: Ussuri-Primor'e region; Korea. During my inspections this species was abundant near the sanctuary close to the Komarovka River.

Biology: Inhabits broad-leaved forests. Flight of beetles commences early June and continues up to second half of July. En masse flight recorded in second half of June. Thus from 1972 to 1973 during systematic collections, of 111 beetles collected 3.6% were found in first 10 days of June, 47.8%—middle 10 days, 29.7%—last 10 days of June, 14.4%—first 10 days of July, and 4.5%—second 10 days of July. Beetles often found on flowers of *Actinidia* (*Actinidia colomicta*), honey-



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Figure 127. Pupa of *Pidonia alticollis* (Kr.).

suckle (*Lonicera edulis*), lilac (*Syringa amurensis*), and other plants. Female lays eggs in bark crevices in basal zone of trunk. In the laboratory eggs were also laid in soil around roots. This species colonizes maple, possibly other wood species. Larvae hatch from eggs 18 to 20 days after oviposition, bore into bark, initially make galleries in bark, then under bark, and plug them with frass. Width of galleries made by mature larvae 7.0 to 8.0 mm. Sometimes galleries fuse into platformlike areas, faintly imprinted on wood. Larvae later nibble oval opening on bark surface, fall through it to the soil, burrow in, and make pupal cell there.

Pupation commences in May and ends in early June. Beetles sighted end of May and in June. Emergence of beetles from soil commences in first 10 days of June and ceases in early part of last 10 days. I found pupae and adults (male and female) in soil under a thick-trunked desiccated maple tree from June 2nd through 13th. Pupa (female) removed from soil on June 2nd weighed 16 mg and the adult emerging June 8th weighed 13 mg.

9. *Pidonia puziloi* (Sols.)

Solsky, 1873, *Hor. Soc. Entom. Ross.*, vol. 9, p. 245 (*Omphalodera*); Plavil'shchikov, 1936, *Fauna SSSR*; 21, 1, 231-232 (*Omphalodera*); Gressit, 1951, *Longicorn Beetles of China*, vol. 2, pp. 75-76; Kojima and Hayashi, 1969, *Insect Life in Japan, Longicorn Beetles*, vol. 1, p. 16, pt. 6, fig. 8.

Adult (Figure 128): Body moderately elongate, small. Head with dense punctation, transverse dent on occiput, rarely with constriction behind eyes that causes temples to project markedly. Antennae thin, with spines reaching beyond middle of elytra (female) or up to hind clivus.

Pronotum elongate, narrows more anteriorly than posteriorly, angularly broadens mediolaterally, raised (gabled) on disk, without perceptible flange on anterior margin; with dense punctation, short light-colored adherent hairs from sides to middle. Scutellum triangularly elongate, pointed apically, with dense minute punctation. Legs long; femora thicken toward apex, almost clavate. Hind tibiae long and slender, gently curved.

Elytra bulge, with parallel sides, rounded together apically (with narrowly rounded inner angle), with very large distinct punctation at base; with semiadherent setaceous hairs and therefore appear densely setaceous under a microscope. Head, abdomen, and pronotum with rusty tinge; underside of thorax light rust with yellowish tinge; antennae light rust with darkened apices. Elytra dark brown, light rust at base and on suture, sometimes light rust up to hind clivus; with yellowish spots laterally anterior to middle and anterior to hind clivus, of which anterior spots slope backward and posterior ones turn obliquely slightly forward. Legs rusty; hind femora sometimes darkened. Length of body 5.0 to 8.0 mm.

Egg: Silvery-white, narrows toward poles, rounded at ends; with minute squarrose sculpture. Length 0.8 to 0.9 mm, width 0.4 mm.

Larva (Figure 129): Very similar to larvae of the subgenus *Pseudopidonia*. Body small, flat. Head flat, narrowly rounded anteriorly. Epistoma demarcated by well-developed white frontal sutures with two setae each. Longitudinal epistomal suture well developed in posterior half,

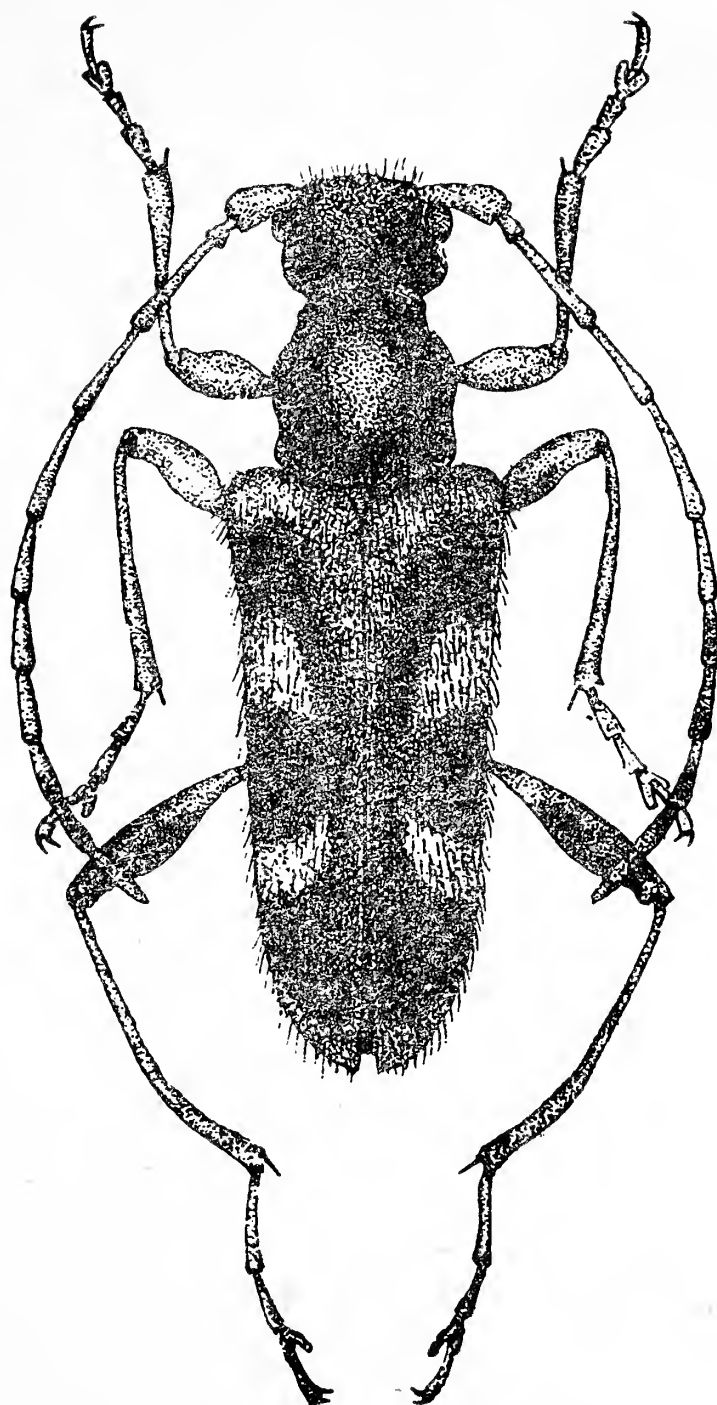


Figure 128. *Pidonia puziloi* (Sols.), male.

with two setae along each side of suture anterior to middle forming common transverse row. Hypostoma flat, narrows somewhat anteriorly, without perceptible median longitudinal band. Three ocelli laterally on head form distinct black band behind antennae. Clypeus broad, trapezoidal, white. Labrum not longer than wide, rounded on anterior margin, with short setae. Mandibles moderately elongate, apically trifid.

220 Pronotum slightly convex, almost flat on disk, 2.5 times longer than wide, finely striate almost throughout entire surface, with sparse thin long hairs laterally, and stray diffuse hairs on anterior margin closer to anterior angles, forming transverse row. Pronotal shield barely demarcated from general surface, lateral longitudinal folds lacking. Pro-

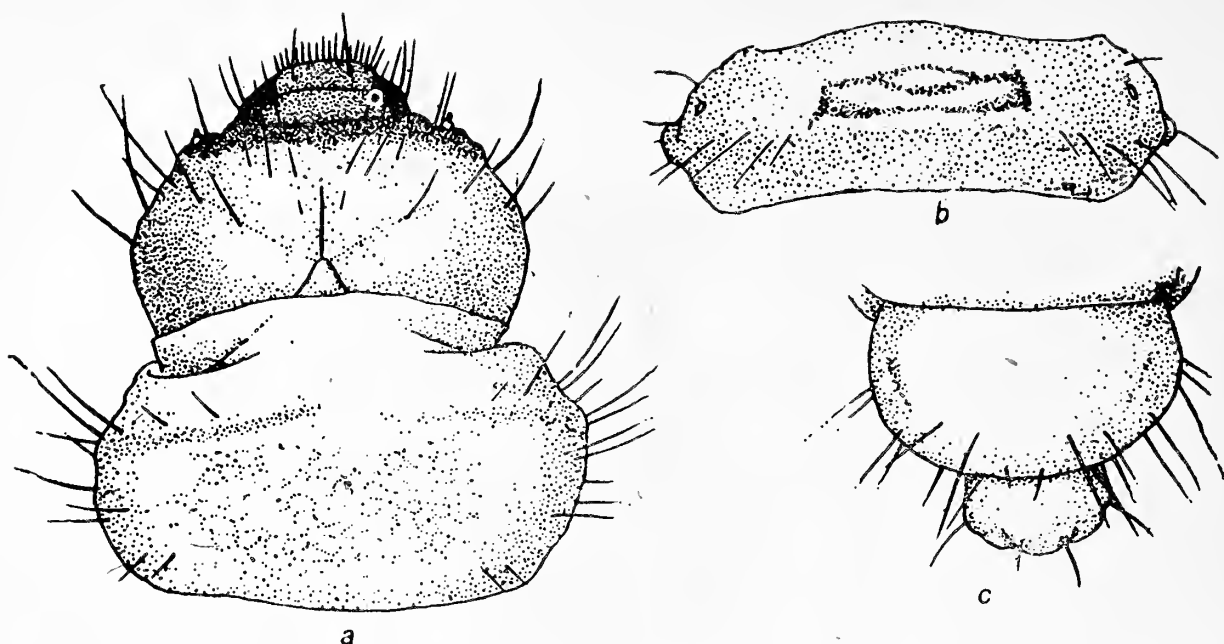


Figure 129. Larva of *Pidonia puziloi* (Sols.).

a—head and pronotum; b—abdominal tergite with locomotory ampulla; c—tip of abdomen.

sternum glabrous, with stray setaceous hairs; eusternum triangular, distinct, narrowly rounded anteriorly, with pair of setaceous hairs forming transverse row in anterior half. Thoracic legs developed, with slightly sclerotized claws.

Abdomen flat, moderately elongate; abdominal segments laterally produced tubercularly. Tergites slightly convex, with four long hairs laterally forming transverse row. Dorsal locomotory ampullae located on first six tergites and consist of two transverse carinae divided by grooves; of these, posterior carina 3.0 times larger than anterior one. Tergite IX on posterior margin with stray long hairs. Sternite IX on posterior margin invariably with four long hairs forming transverse row. Body white. Head rusty, with yellow tinge. Mandibles reddish-brown. Anterior margin of pronotum with yellowish transverse band. Length of body up to 8.0 mm, width of head 1.5 mm. First-instar larvae hatch with large sclerotized spine laterally on meso- and meta-thorax. Small setae laterally on first two or three abdominal segments disappear after molt.

Pupa (Figure 130): Body elongate, slightly curved. Head moderately bent under. Frons convex at base of antennae, with short median longitudinal suture; with sparse setae, of which two short ones on each anterior angle at base of clypeus, one each before antennae, two contiguous on inner side of antennae, and one each behind antennal base. Vertex smooth, broad, and laterally, closer to occiput, with four long setae on each side. Antennae flexed to sides, curved ventrad, annular in second half.

221 Pronotum smooth, bulges, narrows more anteriorly, broadly rounded laterally; with long sparse setae forming broad transverse field on disk, five lateral setae on anterior margin on each side, and carina at base with up to 14 setae arranged in narrow medially interrupted row. Meso- and metanota with long thin setae forming two paramedial tufts each.

Abdomen elongate, thin, gently narrows posteriorly. Abdominal tergites convex in posterior half, with long thin setae here. Tip of abdomen with long dense piliform setae dorsally, bifurcate spinescent process terminally, obtuse, platform shaped ventrally, and laterally bound by smooth carina bearing long piliform setae. Valvifers of female small, tubercular. Length of body 5.9 to 8.0 mm.

Material: Collected in Ussuri-Primor'e region. Adult insects over 500, larvae 25, pupa one.

Distribution: Region of Amur basin, Ussuri-Primor'e region, Sakhalin; northeast China, Korea, Japan. Very abundant in Ussuri-Primor'e region.

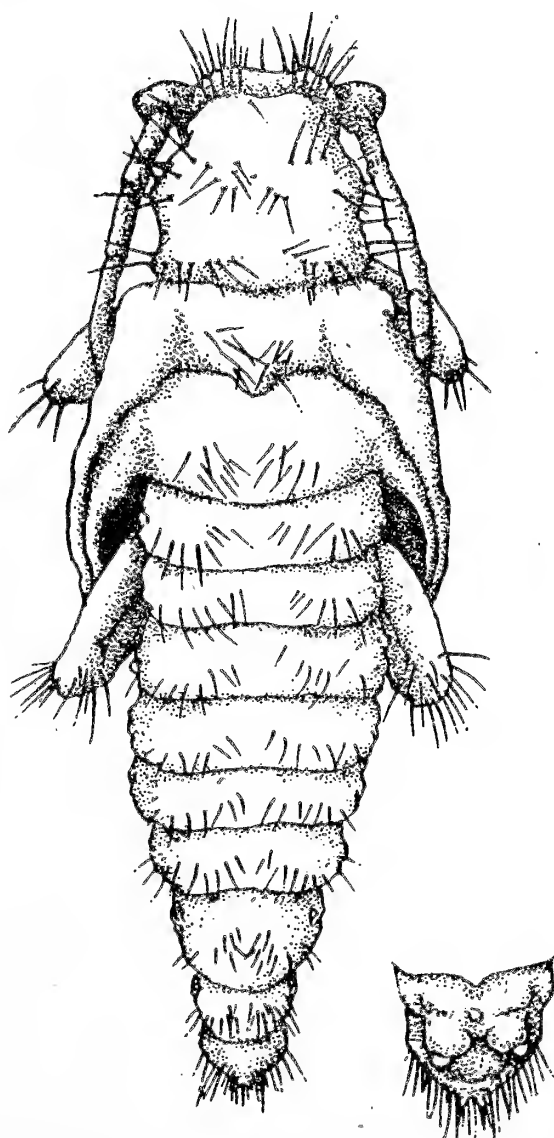


Figure 130. Pupa of *Pidonia puziloi* (Sols.), female.

Biology: Inhabits broad-leaved forests. Flight of beetles commences early June and ceases in second half of July. Beetles maximum in last 10 days of June and first 10 days of July. Thus from 1971 to 1972 during systematic collections on the Kovarovka River, of 469 beetles collected 1.3% were found in first 10 days of June, 18%—second 10 days, 30.5%—last 10 days of June, 44.7%—first 10 days of July, and 5.5%—second 10 days of July. Beetles feed on flowers of Umbelliferae, Rosaceae, and other plants. Often found on flowers of mountain ash (*Sorbaria sorbifolia*). They are most active from 11:00 a.m. to 6:00 p.m. During this period they feed, mate, and the female oviposits. During rains and very warm weather beetles hide in grass cover and quite often remain in shaded grass. In gardens the female readily oviposits on thin shoots of Ussuri pear (*Pyrus ussuriensis*), rarely on bird-cherry (*Padus asiatica*), ash (*Fraxinus*), elm (*Ulmus*), and other wood species. Eggs usually laid singly in bark crevices. Decaying or dead shoots are colonized. Under natural conditions at a mean daily temperature of 19.5°C, larvae hatch 14 to 25 days after oviposition.

Larvae hatch en masse end of July. In hatching they pierce the chorion, then bore into bark and make galleries along shoots without affecting wood. Galleries are plugged with fine bark frass. Mature larvae abandon galleries, fall onto soil surface, burrow, and make pupal cell at a depth of 3.0 to 5.0 cm. Length of cell 5.0 to 6.0 mm, width 3.0 to 4.0 mm. Larvae enter diapause in cell before pupation. Under laboratory conditions diapause sometimes continued for more than a month from moment of preparation of pupal cell to pupation. Thus one larva entered the soil and had prepared a pupal cell by April 21, but pupated only on May 30, i.e., 40 days later. This phenomenon has also
 222 been observed in nature. Furthermore, larval entry into soil is completed by the end of summer while pupation occurs mainly in the following May or early June. In 1973 I found a pupa in soil under a dead pear tree on May 27 and saw the beetles emerge from it on June 7th. Soil temperature under this pear tree was 12°C. Weight of larvae before pupation in cell 6.0 to 13.0 mg, pupae 5.0 to 12.5 mg, and adult 4.0 to 9.5 mg. Larvae of *Pidonia debilis* (Kr.) often enter soil for pupation together with this species. The two species are very similar and difficult to differentiate.

15. Genus *Pseudallosterna* Plav.

Plavilstshikov [Plavil'shchikov], 1934, *Entom. Blätt.*, vol. 30, p. 131; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 17.

Adult: Body moderately elongate, with comparatively broad head, long antennae, and convex pronotum rounded laterally in anterior half.

Larva: Body flat. Pronotum smooth, with stray long hairs only laterally; pronotal shield bulges, elongate, anterior margin medially triangular.

This genus consists of a single species inhabiting broad-leaved forests of the Far East.

Type species: *Pseudallosterna orientalis* Plavilstshikov, 1934.

1. ***Pseudallosterna orientalis* Plav.**

Plavilstshikov [Plavil'shchikov], 1934, *Entom. Blätt.*, vol. 30, p. 148; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 258–259; Cherepanov and Cherepanova, 1975, *Zhuki-drovoseki ivovyykh lesov Sibiri*, pp. 48–51.

Adult (Figure 131): Body small and slender. Head turned antero-

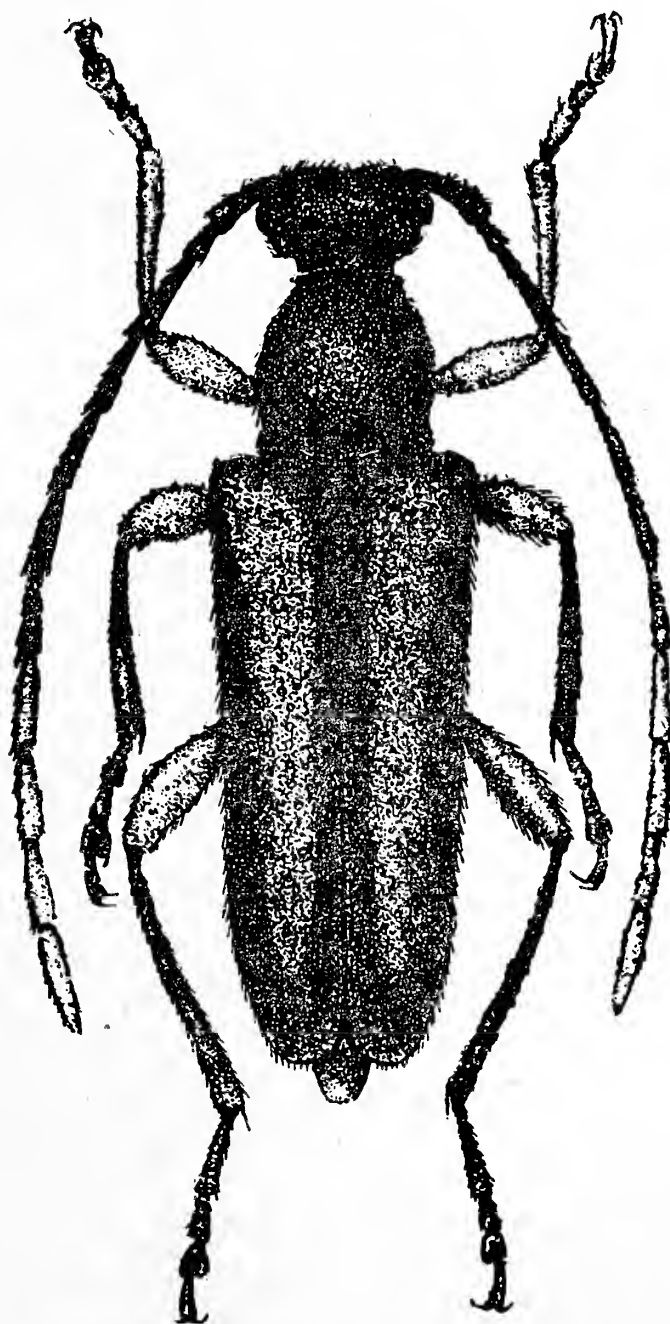


Figure 131. *Pseudallosterna orientalis* Plav.

ventrally at an angle of about 45° ; cervix behind temples sharp; with large dense punctation. Frons between antennae with short longitudinal suture. Eyes convex, with shallow emargination. Antennae shifted anteriorly, not widely separated, somewhat thickened apically, reach just beyond middle of elytra in female, almost reach elytral apices in male.

Pronotum rounded and convex, markedly narrows anteriorly but barely so posteriorly; with uniformly dense deep punctation and semi-adherent short hairs. Punctation large, round, umbilicate; spaces between smaller than punctures per se. Scutellum small and triangular, pointed apically.

Elytra parallel, convex, with straight, somewhat bulging humeri, rounded individually at apex; with sparse, tender, gray, semiadherent hairs, and large deep simple punctation; spaces between them larger than punctures per se. Legs comparatively long; fore- and midfemora clavate, dilated in second half, hind femora uniformly thickened and longer. Hind tarsi slender, slightly shorter or even not shorter than tibiae. Abdomen of female thick, gradually narrows posteriorly. Tip of abdomen exposed, not covered by elytra dorsally. Body black. Antennae black, with rusty tinge apically. Elytra straw-yellow, darkened along suture, laterally, and apically. Legs light colored, rusty; hind tibiae and tarsi, sometimes midtibiae and tarsi also, dark brown. In some specimens dark coloration extends to major part of elytra. Length of body 4.5 to 5.5 mm.

Larva (Figure 132): Resembles larvae of *Pseudopidonia* in structure of head and general habits. Differs in structure of pronotal shield and other features that are not readily discernible. Body narrows from thorax to apex. Head flat, half of it retracted into prothorax. Epistoma demarcated by sharp white frontal sutures (sutura frontalis), medially divided by longitudinal suture (sutura medialis). Hypostoma narrows anteriorly, white median longitudinal band laterally with one seta on each side. Ocelli on anterior margin of head (visible in lateral view) located near antennal bases and look like transverse uneven minute black spots fused in pairs. Clypeus trapezoidal and smooth. Labrum transversely oval, with dense setae on anterior margin. Mandibles elongate, obliquely truncate apically. Prothorax broad, sparse hairs ventrally; pair of long setaceous hairs on anterior margin of eusternum.

Pronotum transverse, smooth on disk, with sparse (stray) long hairs only laterally. Pronotal shield angularly elongate anteromedially on anterior margin, acutely produced at anterior angles. Thoracic legs well developed, with acute acicular claws.

Abdomen narrows posteriorly, somewhat pointed terminally. Abdominal tergites transverse, with long hairs forming transverse row laterally between locomotory ampullae and spiracles. Dorsal locomotory

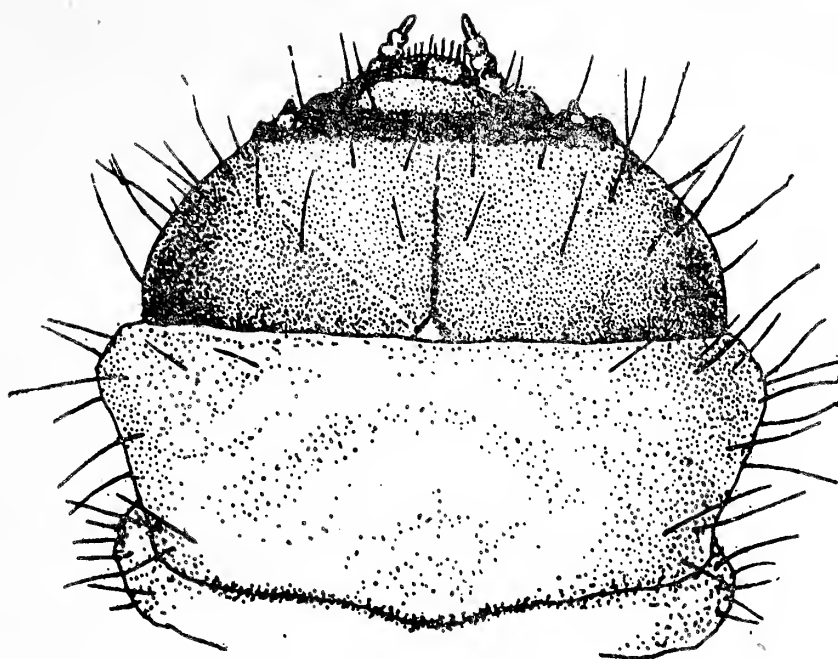


Figure 132. Head and pronotum of larva of
Pseudallosterna orientalis Plav.

ampullae convex, shagreen, divided by three transverse grooves on first four tergites and two grooves on next three tergites, and laterally demarcated by longitudinal folds. Ventral locomotory ampullae divided medially by transverse groove that joins laterally with short longitudinal folds. Tip of abdomen with three hemispherical anal lobes covered with long hairs. Body white. Head rusty-yellow, with black border on anterior margin. Mandibles rusty-brown, almost black. Anterior margin of pronotum with transverse yellow band. Body length of mature larva up to 10 mm. Pupa not known.

Material: Collected in Ussuri-Primor'e region. Adult insects over 50, larva one.

Distribution: Ussuri-Primor'e region. Found in forests of Ussuri, Shkotovsk, and Khasan regions.

Biology: Inhabits deciduous vegetation. Ecologically associated with aralia, willow, and possibly other wood species. Flight of beetles commences in June and ends in first half of August. We found a beetle in a willow stump close to Primor'e region, which weighed 7.5 mg. Larvae live in and under bark in basal zone of trunks and on roots. Beetles found during flight period on trunks of aralia; larvae found in bark of dead plants of this species.

7. Tribe LEPTURINI

Adult insects with antennae set between eyes. Prothorax narrows anteriorly, rounded laterally, rarely produced into lateral tubercle

(*Eustrangalis distenoides* Bat.); transverse suture lacking ventrally between coxae and anterior margin, slopes evenly. Elytra elongate, rounded, truncate or notched apically.

Eggs elongate, usually with cellular sculpture, rarely smooth, but then with fairly perceptible cells or coarse projection at poles.

Larvae characterized by mandibles obliquely notched apically; labrum broadly rounded at anterior margin. Epistoma posteriorly pointed with single apex. Pronotal shield coriaceous, nonsclerotized, without lateral longitudinal folds. Locomotory ampullae with granules, usually located on abdominal segments I to VII, rarely on I to VI. Sometimes dorsal locomotory ampullae occur on segments I to VI and ventral ones on segments I to VII (*Allosterna*). Posterior margin of abdominal tergite IX rounded, with dense or sparse hairs, without spinules or, as an exception, with small pointed spinule [*Judolidia bangi* (Pic)].

Pupae characterized by more or less developed occipital tubercles laterally on head behind eyes, and arcuate or semicircular antennae. Pronotum narrows anteriorly, bulges moderately on disk, without laterally produced tubercles, with spinules or setae forming transverse row or band on posterior (sometimes anterior) margin. Abdominal tergites with spinules or piliform or thick acicular setae that usually form transverse band or row along sides of longitudinal groove. Tip of abdomen with or without urogomphi.

The tribe Lepturini to date has not been distinctly classified as a whole nor generically. Different authors have even placed the same species under different genera. Moreover, some taxa (*Judolia*, *Judolidia*, and others) have been treated by some authors (Plavil'shchikov, 1936; Kojima and Hayashi, 1960) as independent genera, but regarded by other authors as subgenera (Gressit, 1951; and others). In this book the tribe Lepturini has been adopted as defined by Plavil'shchikov (1936) with some minor modifications. Such a scheme accords quite well with ecological groupings, introduces clarity into the formulation of keys to taxa in different developmental stages, and essentially reflects the phylogenesis of the tribe as a whole.

The group *Judolia*-*Oedecnema*, ecologically associated with the root zone of wood species, forms the basis of the tribe Lepturini. In ecological and morphological characteristics of larvae, it represents a transitional link from the tribe Stenocorini to the tribe Lepturini. Close to it is the group *Cornumutila*-*Strangalomorpha*, characterized in the larval stage by considerable sclerotization of locomotory ampullae and the development of fine granules on them. The transition from this group to the group *Grammoptera*-*Allosterna* is readily traceable, in which members are characterized in the larval stage by small body size, insignificant sclerotization of locomotory ampullae, and other features.

Finally, the genera *Anoplodera-Eustrangalis*, characterized by similar structure of dorsal locomotory ampullae in the larvae, constitute a large group; the ampullae have four rows of granules forming two transversely elongate ellipses. All the foregoing groups are ecologically associated with wood species and colonize dead or decaying trees.

KEY TO GENERA

Adult Insects

- 1 (6). Genae shorter than half width of lower lobe of eye.
- 2 (3). Pronotum not longer than width at base, with large deep punctation on disk. 1. **Cortodera** Muls.
- 3 (2). Pronotum elongate, distinctly longer than width at base, with dense minute punctation on disk.
- 4 (5). Head behind eyes with slight cervix, temples and occiput turned backward, at least not suspended. Pronotum in posterior half slightly compressed or not compressed laterally. 2. **Grammoptera** Serv.
- 5 (4). Head behind eyes with sharp cervix, temples and occiput suspended at posterior margin. Pronotum in posterior half distinctly compressed laterally and hence appears roundly enlarged anterior to middle. 3. **Allosterna** Muls.
- 6 (1). Genae longer than half width of lower lobe of eye.
- 7 (14). Pronotum barely enlarged basally, with posterior angles rounded, not produced, at least not pointed.
- 8 (9). Elytra with longitudinal yellow bands. Frons on anterior margin with smooth triangular nonpunctate clearance. 4. **Cornumutila** Letzn.
- 9 (8). Elytra without longitudinal yellow bands, monochromatic. Frons on anterior margin usually with minute punctation, without smooth triangular clearance; if latter present, elytra entirely black (*Nivellia extensa*).
- 10 (11). Elytra flat, with parallel sides, matte. Pronotal disk with broad median longitudinal depression. 5. **Nivellia** Muls.
- 11 (10). Elytra somewhat convex, narrow more or less toward apex, usually lustrous; if matte, pronotal disk without broad median longitudinal depression, at most with narrow longitudinal groove.
- 12 (13). Body narrow, elongate; total width of elytra at humeri 0.33 length. Legs long and slender; hind femora barely thicker than tibiae. 6. **Strangalomorpha** Sols.
- 13 (12). Body comparatively thick, total width of elytra at humeri

- about 0.40 to 0.50 length. Legs thick; hind femora 2.0 to 2.5 times thicker than tibiae. 7. **Anoplodera** Muls.
- 14 (7). Pronotum broadens significantly at base, with posterior angles pointed, produced posterolaterally.
- 15 (18). Body stocky, comparatively thick. Pronotum bulges, broad, with deep transverse depression basally. Elytra convex, individually rounded apically.
- 16 (17). Antennae barely reach apex of elytra (male) or only cross midlength (female). Elytra usually with spotted or transversely banded pattern. 8. **Judolia** Muls.
- 17 (16). Antennae reach beyond apex of elytra (male) or only reach hind clivus (female). Elytra invariably monochromatic, black, without pattern. 9. **Judolidia** Plav.
- 226 18 (15). Body elongate. Pronotum elongate, distinctly campanulate. Elytra usually notched apically, rarely rounded.
- 19 (20). Hind femora in male markedly dilated; hind tibiae broaden toward apex, distinctly curved. 10. **Oedecnema** Thoms.
- 20 (19). Hind femora in male not dilated, moderately thickened.
- 21 (24). Pronotum without perceptible lateral tubercle, narrowly rounded anteriorly.
- 22 (23). Body moderately elongate. Hind tarsi without visible 4th segment. 11. **Leptura** L.
- 23 (22). Body narrow, markedly elongate. Hind tarsi with distinct projecting 4th segment. 12. **Strangalia** Serv.
- 24 (21). Pronotum laterally with produced conical tubercle. Elytra markedly narrow posteriorly, deeply notched apically. 13. **Eustrangalis** Bat.

Larvae

- 1 (4). Anterior half of pronotum with faint, narrow, yellowish transverse band.
- 2 (3). Dorsal locomotory ampullae developed on abdominal tergites I to VII. 2. **Grammoptera** Serv.
- 3 (2). Dorsal locomotory ampullae developed on abdominal tergites I to VI. Tergite VII smooth, without ampulla. 3. **Allosterna** Muls.
- 4 (1). Pronotum in anterior half with broad yellowish transverse band.
- 5 (10). Dorsal locomotory ampullae with fine granules forming transverse rows interrupted medially by longitudinal, usually broad sclerotized groove.
- 6 (9). Eusternum not sclerotized, without noticeable spinules, slightly shagreen.

- 7 (8). Propleura with dense indistinct specklike spinules, not imparting coarse appearance. 4. **Cornumutila** Letzn.
- 8 (7). Propleura with dense setaceous spinules (lateral view), imparting distinct coarse appearance (almost resemble short setae). 6. **Strangalomorpha** Sols.
- 9 (6). Eusternum sclerotized, with minute brown spinules, usually forming broad medial transverse band. . . . 5. **Nivellia** Muls.
- 10 (5). Dorsal locomotory ampullae usually with large (rarely minute) granules forming transverse rows interrupted medially by narrow nonsclerotized longitudinal groove, or with transverse sclerotized carina bound by faint but large granules.
- 11 (16). Dorsal locomotory ampullae with well-developed, broad, sclerotized transverse carina covered with minute brownish spinules; large, barely developed granules occur only along edges of this carina.
- 12 (15). Abdominal tergite IX anterior to middle usually smooth, without hairs.
- 13 (14). Abdominal tergite IX rounded at posterior margin, without spinule, with long dense hairs forming tufts. . . 8. **Judolia** Muls.
- 14 (13). Abdominal tergite IX produced at posterior margin, with acute rusty or reddish spinule, and sparse hairs not forming distinct tufts. 9. **Judolidia** Plav.
- 15 (12). Abdominal tergite IX anterior to middle with four long setaceous hairs forming transverse row, dense hairs on posterior margin. 10. **Oedecnema** Thoms.
- 227 16 (11). Dorsal locomotory ampullae without transverse sclerotized carina, with lustrous granules in four transverse rows forming two transversely elongate ellipses.
- 17 (20). Anterior margin of yellow transverse band on pronotum with deep white saccate notches; if latter absent [*Leptura vicaria* (Bat.), *L. circaocularis* (Pic), *L. femoralis* (Motsch.)] dorsal locomotory ampullae with lateral longitudinal groove.
- 18 (19). Dorsal locomotory ampullae without visible lateral longitudinal groove. 7. **Anoplodera** Muls.
- 19 (18). Dorsal locomotory ampullae with lateral longitudinal, somewhat oblique groove and also lateral granules. . . 11. **Leptura** L.
- 20 (17). Anterior margin of yellow transverse band on pronotum entire, without deep saccate notches. Dorsal locomotory ampullae without lateral longitudinal groove.
- 21 (22). Ocelli two, hyaline, one on each side of head at antennal bases. 12. **Strangalia** Serv.
- 22 (21). Ocelli three on each side of head, forming transverse band at antennal bases. 13. **Eustrangalis** Bat.

Pupae

- 1 (4). Length of body up to 7.0 mm.
- 2 (3). Urogomphi on tip of abdomen straight, widely separated. 2. **Grammoptera** Serv.
- 3 (2). Urogomphi straight or falcate and bent upward at tip of abdomen, not widely separated but close, sometimes located on common protuberant base. 3. **Allosterna** Muls.
- 4 (1). Length of body over 10.0 mm.
- 5 (10). Tip of abdomen without urogomphi; if urogomphi present (genus *Strangalomorpha*), hind femora long, pressed to sides of body, and extend beyond abdominal tergite V.
- 6 (9). Urogomphi absent on tip of abdomen.
- 7 (8). Pronotum on anterior margin with dense minute setae forming transverse band; basally with large acicular setae on protuberant coriaceous base forming transverse row or band widely interrupted medially. 4. **Cornumutila** Letzn.
- 8 (7). Pronotum with smooth anterior margin, without setae; sparse short spinescent setae at base do not form distinct transverse band. 5. **Nivellia** Muls.
- 9 (6). Urogomphi present on tip of abdomen, not large, moderately separated; falcate, bent upward. . . 6. **Strangalomorpha** Sols.
- 10 (5). Tip of abdomen with more or less developed urogomphi. Hind femora cross only abdominal tergite III or IV.
- 11 (14). Body stocky, somewhat concave dorsally. Hind femora markedly bent dorsally. Abdominal tergites with dense long thin setae forming tuft or transverse band along sides of longitudinal groove. Urogomphi on tip of abdomen short, contiguous.
- 228 12 (13). Head short, not rostriform, not longer than wide, transversely convex between antennae, and deeply impressed behind antennae between upper lobes of eyes. 8. **Judolia** Muls.
- 13 (12). Head long, anteriorly rostriform, bent under, considerably longer than wide, slightly convex between antennae, and smooth behind antennae between upper lobes of eyes. 10. **Oedecnema** Thoms.
- 14 (11). Body elongate, not dorsally concave. Hind femora slightly bent dorsally. Abdominal tergites with short spinules or thick acicular setae.
- 15 (20). Abdominal tergites with short spinules. If with large acicular setae, urogomphi lacking on tip of abdomen (*Leptura femoralis*).
- 16 (17). Pronotum with identical acicular spinules, diffuse throughout

- surface. Urogomphi on tip of abdomen straight, widely separated. 9. **Judolidia** Plav.
- 17 (16). Pronotum usually with minute diffuse spinules on disk and very large spinules at base forming dense transverse row or band.
- 18 (19). Pronotum with straight or curved posterior angles, not produced laterally. 7. **Anoplodera** Muls.
- 19 (18). Pronotum with distinct laterally produced posterior angles. 11. **Leptura** L.
- 20 (15). Abdominal tergites with long thick acicular setae bent down and backward.
- 21 (22). Pronotum elongate, smooth on disk, with acute posterior angles markedly produced laterally. Urogomphi on tip of abdomen widely separated, directed dorsolaterally. 12. **Strangalia** Serv.
- 22 (21). Pronotum slightly elongate, with long sparse setae on disk, and rounded, not produced posterior angles. Urogomphi on tip of abdomen contiguous, directed posterodorsally. 13. **Eustrangalis** Bat.

1. Genus *Cortodera* Muls.

Mulsant, 1863, *Coleopt. France, Longicorn*, 2nd ed., p. 572; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 262-263.

Adult: Distinguished by very broad convex pronotum, short genae, and other features. Body slightly elongate. Head broad and short. Eyes convex, somewhat emarginate in some species. Antennal apices reach beyond middle of elytra. Temples project, genae very short. Pronotum short, not longer or only slightly longer than width at base. Elytra bulge, with parallel sides in female.

Rarely found in Siberia, seldom in Altai and the Far East, which essentially signifies that the genus *Cortodera* was widespread in the pre-Glacial Tertiary period. At present, preserved in the Mediterranean region and partly in central Europe. Elsewhere it has undergone marked depletion and is facing extinction, for example, in northern Asia.

Type species: Leptura humeralis (Schaller, 1783).

229 KEY TO SPECIES

Adult Insects

- 1 (6). Last segment of maxillary palps elongate, with parallel sides, straightly truncate apically.

- 2 (3). Pronotal disk without smooth longitudinal band. 1. **C. humeralis** (Schall.).
 3 (2). Pronotal disk with smooth longitudinal band.
 4 (5). Fifth antennal segment longer than 3rd. Elytra with long hairs (apex of one usually extends posteriorly beyond base of next hair). 2. **C. femorata** (F.).
 5 (4). Fifth antennal segment shorter than 3rd. Elytra with short hairs (apex of one usually does not extend posteriorly beyond base of next hair). 3. **C. ussuriensis** Tsher.
 6 (1). Last segment of maxillary palps not laterally parallel, broadens toward apex, tapers apically.
 7 (10). Pronotum anterior to base (on hind clivus) without broad smooth area, at most with short lustrous line at bottom of broad longitudinal groove.
 8 (9). Elytra less elongate, almost 2.5 times longer than width at humeri. 4. **C. analis** (Gebl.).
 9 (8). Elytra more elongate, almost 3.0 times longer than width at humeri. 5. **C. semenovi** Plav.
 10 (7). Pronotum anterior to base (on hind clivus) with broad smooth longitudinal area, usually impressed. . . . 6. **C. ruthena** Plav.

1. **Cortodera humeralis** (Schall.)

Schaller, 1783, *Schrift. Nat. Gesel. Halle*, vol. 1, p. 297 (*Leptura*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 266-268.

Adult: Body large, moderately elongate. Head with sharp cervix behind temples. Temples long, with parallel sides, with straight posterior angles (male) or converge somewhat backward with rounded posterior angles (female). Antennae reach beyond middle of elytra (female) or beyond hind clivus (male); 4th antennal segment shorter than 3rd but longer than 1st; 5th longer than 3rd.

Pronotum markedly narrows anteriorly, roundly enlarged medio-laterally, convex on disk, with median longitudinal groove set with uniform punctation, and with dense compact yellowish hairs.

Elytra somewhat convex on disk, with parallel sides (female) or gradually but slightly narrow toward apex, rounded together apically; with moderate punctation forming distinct striation, and light-colored, somewhat short adherent hairs. Body black. Elytra with greenish iridescence; rusty-yellow spots basally (one spot on scutellum, the other on humerus), rarely monochromatic black (ab. *inhumeralis* Pic); sometimes elytra yellow with darkened suture (ab. *suturalis* F.), or with darkened apex and darkened lateral margin (ab. *discoidalis* Pic). Legs usually black, femoral bases and foretibiae reddish-rust with yellow tinge. Antennae brownish, rusty-yellow basally, lighter in color. Length 8.0 to 10.0 mm.

Distribution: Europe, from Baltic coasts to the southern Urals inclusive. Flight of beetles in June. Inhabits deciduous vegetation.

230 2. *Cortodera femorata* (F.)

Fabricius 1787, *Mant. Ins.*, vol. 1, p. 159 (*Leptura*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 268–269.

Adult: Proximate to *C. humeralis* and *C. ussuriensis*. Differs from them in elytral punctation and antennal structure. Head with sharp cervix behind temples. Temples long, not shorter than eyes, parallel in male, slightly taper posteriorly in female. Antennae comparatively long, with apices extending beyond 0.75 length of elytra (male) or almost reach that level (female); 3rd antennal segment longer than 4th, shorter than 5th.

Pronotum markedly narrows anteriorly, angularly broadens medially, somewhat shorter than width at base, convex; with broad longitudinal groove with smooth band, dense punctation, and dense minute sessile yellowish hairs.

Elytra elongate, with parallel sides, or gradually narrow somewhat posteriorly, rounded together apically; with dense minute punctation and sparse, sessile, very long, light-colored hairs. Body black, tip of abdomen quite often reddish. Antennae black, rusty basally, lighter in color. Forelegs and also bases of mid- and hind femora rusty, with yellow tinge (f. *typica*); sometimes elytra reddish laterally (ab. *monticola* Ab.), or uniformly rusty-yellow (ab. *flavipennis* Reitt.), or with dark spot laterally and darkened suture (ab. *suturifera* Reitt.). Length 8.0 to 11.0 mm.

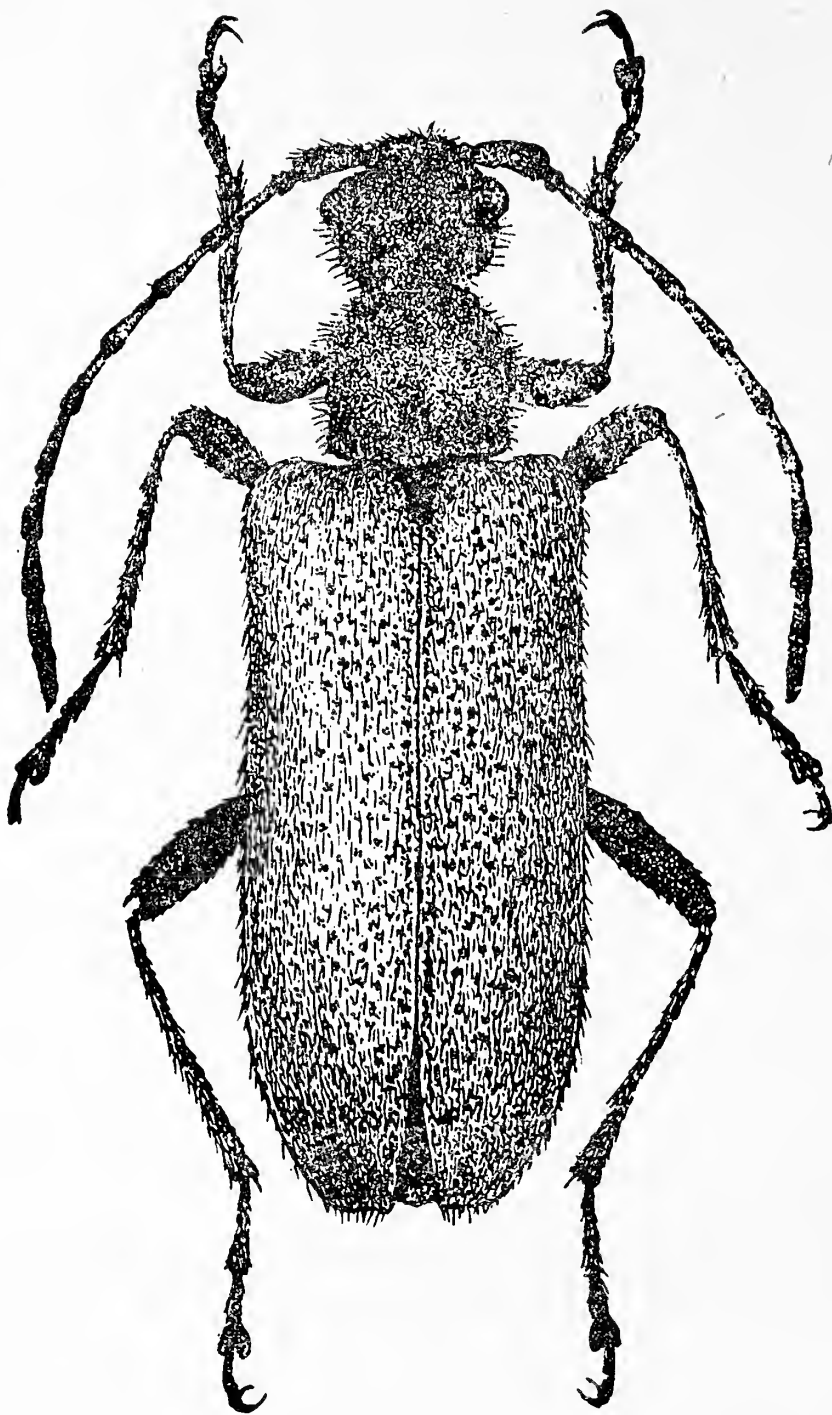
Distribution: From Baltic coasts to the Urals inclusive. Flight of beetles from June through July.

3. *Cortodera ussuriensis* Tsher.

Cherepanov, 1978, *Taksonomiya i ekologiya chlenistonogikh Sibiri* (Nov. i maloizv. vidy fauny Sibiri), pp. 97–103.

Adult (Figure 133): Body moderately elongate. Head short, not narrower than pronotum, transversely raised between antennae, with short, barely perceptible genae, sharp cervix posteriorly, angularly projecting rounded temples; with dense punctation, and adherent hairs (erect on temples). Eyes large, convex, finely faceted, slightly longer than temples. Antennae notably thicken from 1st segment to apex, short; 11th segment extends beyond middle of elytra; 5th segment shorter than 3rd, distinctly longer than 4th; 11th segment elongate, pointed apically. Last segment of maxillary palps elongate, with parallel sides, straightly truncate apically.

Pronotum not longer than width at base (angularly broadens



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Figure 133. *Cortodera ussuriensis* Tsher.

anteromedially), narrows insignificantly, and convex toward anterior margin; with dense round punctation (spaces between them shorter than punctures per se), and smooth median longitudinal band in posterior half; with light-colored tender adherent hairs forming vortex along each side of smooth longitudinal band. Scutellum elongate, triangular, narrowly rounded apically, edged laterally with individual uneven punctures.

Elytra bulge, with parallel sides, rounded together apically, with straight inner angles and rounded humeri; with small uniform punctation and short semiadherent light-colored hairs not forming compact cover. Legs not long; femora thicken insignificantly. Hind tibiae consi-

derably longer than tarsi. First segment of hind tarsi slightly longer than successive two, 3rd segment bifurcate almost up to base. Body ventrally with minute notched punctation forming transverse striae on metathorax and abdomen, with yellowish tender adherent hairs. Body black, tip of abdomen light red. Frons at base of antennae, cervix, 231 underside of temples, anterior margin of pronotum (border) reddish-rust. Antennae rusty toned from base almost up to middle, then dark brown, almost black apically. Scutellum black. Elytra light colored, straw-yellow. Legs black, femora light rust basally. Length of body 9.0 mm.

Distribution: Ussuri-Primor'e region; female found on June 24, 1971 near Komarovka River on hill slope (Cherepanova).

Biology: Not studied.

4. *Cortodera analis* (Geb.)

Gebler, 1830, *Ledebour Reise*, 11, 2, 19 (*Pachyta*); *haemorrhoidalis*, Pic, 1898, *Synops.*, p. 114; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 283-284.

Adult: Body slightly elongate. Head short, narrows angularly behind eyes. Temples almost parallel, not shorter than eyes, with projecting, somewhat rounded posterior angles. Antennae comparatively long, with apices reaching beyond middle of elytra in female and up to hind clivus in male.

Pronotum convex, roundly broadens mediolaterally, not longer than width at base, with broad median longitudinal groove, sometimes with smooth band in posterior half; with dense punctation and erect light-colored hairs.

Elytra comparatively convex, with parallel sides (female) or narrow slightly toward apex almost from base (male); with large deep punctation (denser at base), and long light-colored hairs (erect in anterior half). Body black. Elytra lustrous with metallic iridescence. Abdomen reddish at tip. Legs rusty-red; femora and tibiae darkened apically. Antennae black with reddish 1st segment (f. *typica*) or legs black, only foretibiae reddish-rust (ab. *hirta* Geb.), or legs and abdomen black (ab. *nigriventris* Plav.), or antennae reddish-rust (ab. *ruficornis* Pic).

Distribution: Altai (Shebalino), Salair (Kondoma River). Beetles sighted in June; found rarely.

5. *Cortodera semenovi* Plav.

Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 284-285.

Adult: Body elongate. Head comparatively broad, with dense punctation, tender hairs, distinctly parallel temples, broadly rounded projecting posterior angles. Antennal apices reach beyond 0.50 (female) or 0.75 232 (male) length of elytra.

Pronotum significantly narrows anteriorly but negligibly posteriorly, roundly enlarged laterally anterior to middle, convex on disk, moderately punctate, with dense erect light-colored hairs, with short smooth median longitudinal band.

Elytra elongate, narrow gradually toward apex in male, with parallel sides in female, rounded together apically; with erect hairs basally, yellowish hairs bent downward elsewhere on surface, with moderately deep punctation. Body black. Elytra brownish-yellow, with small dark spot along sides of base and darkened suture. Antennae and legs black. Abdominal sternites V and IV partly red (f. *typica*). Sometimes elytra rusty-yellow, antennae red toned, legs reddish-yellow with blackened apices on mid- and hind tibiae and femora (ab. *clementzi* Plav.), or body monochromatic black and antennae reddish at apex (ab. *atra* Plav.). Length 10 to 11 mm.

Distribution: Altai (around Biisk), Salair (Kondoma River). Flight of beetles in June.

6. *Cortodera ruthena* Plav.

Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 286-287.

Adult (Figure 134): Body moderately elongate. Head broad, with dense punctation, long sessile hairs, partly erect anteriorly. Temples with sharply projecting posterior angles. Antennae thin, reach beyond 0.66 length of elytra; 3rd segment longer than 4th, only slightly shorter than 5th or equal to it.

Pronotum broadly rounded laterally, bulges markedly, with narrow flange on anterior margin; with dense large punctation, broad longitudinal smooth area medially on hind clivus, dense adherent hairs, individual long projecting setae laterally beyond middle.

Elytra convex, with parallel sides, dense large punctation, and dense long semiadherent light-colored hairs. Body black. Antennae light rust, darkened apically. Legs rusty-red. Elytra straw-yellow (f. *typica*), sometimes black (ab. *zhuravlevi* Plav.). Length 6.5 to 9.0 mm.

Distribution: Southern Urals. Flight in June. Inhabits deciduous forests.

2. Genus *Grammoptera* Serv.

Serville, 1835, *Ann. Soc. Entom. France*, vol. 4, p. 215; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 291-293.

Adult: Distinguished by small body. Head broad, not elongate in front of antennae, with dense punctation; genae short, temples rounded, antennae somewhat thickened apically, extend beyond 0.50 (female) or 0.75 (male) length of elytra. Elytra with parallel sides, individually rounded apically.

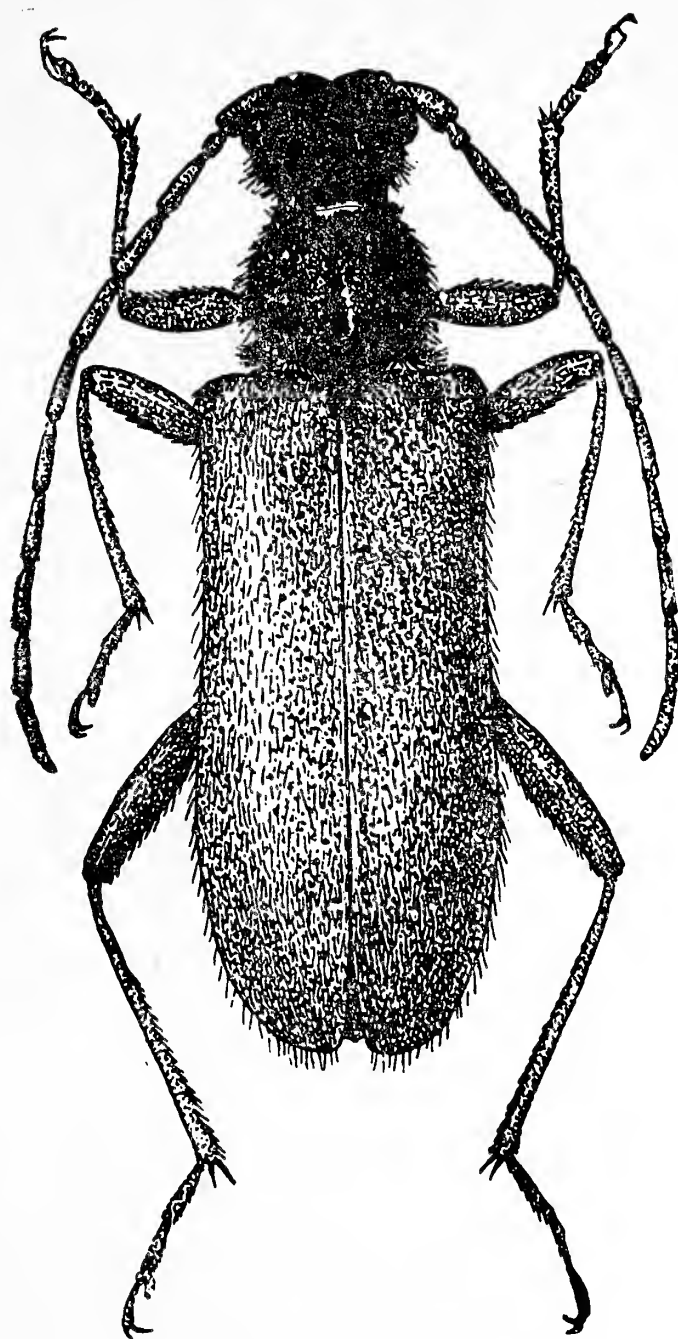


Figure 134. *Cortodera ruthena* Plav.

Egg: White, elongate, with cellular sculpture.

Larva: Body not flat. Parietals broaden angularly or roundly; three pigmented ocelli at antennal bases. Prosternum with sparse stray hairs. Dorsal and ventral locomotory ampullae occur on first seven abdominal segments, with small granules.

Pupa: Body elongate. Abdomen broadens from segments III to V; tip with pair of widely separated urogomphi sclerotized terminally.

This genus consists of six species in USSR fauna, of which about three are found in southern Siberia. However, the validity of *Grammoptera coerulea* Jurec., described on the basis of a lone specimen caught near Vladivostok, requires confirmation.

Type species: *Leptura ruficornis* Fabricius, 1781.

KEY TO SPECIES

Adult Insects

- 1 (4). Elytra black, without metallic luster.
- 2 (3). Pronotum not laterally compressed in posterior half, notably narrows toward head in anterior half. . . . 1. *G. gracilis* Brancs.
- 3 (2). Pronotum distinctly compressed laterally in posterior half, hence enlarged in anterior half, and rounded at anterior angles. 2. *G. erythropus* (Geb1.).
- 4 (1). Elytra bluish-green, with metallic sheen. 3. *G. coerulea* Jureć.

1. *Grammoptera gracilis* Brancs.

Brancsik, 1914, *Ber. Mus. Kom. Trensc.*, p. 58; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 299-300.

Adult (Figure 135): Distinguished from other species by much longer 2nd segment of antennae; markedly bulging elongate pronotum that narrows somewhat and is rounded anteriorly. Body small, slender, moderately elongate. Head convex between antennae, with faint median longitudinal suture or without it, with dense uniform punctation, and narrows gradually behind eyes. Temples taper, not prominent; cervix deeply punctate. Antennal apices extend beyond middle of elytra in female, reach hind clivus in male. Second antennal segment elongate, markedly longer than wide; 5th segment longer than 4th, shorter than 3rd or equal to it.

Pronotum elongate, markedly convex, narrows in anterior third, somewhat broadly rounded in middle, with posterior angles insignificantly produced; with dense uniform punctation, and short compactly adherent hairs, visible only under high magnification, and thus appears smooth. Scutellum triangular, narrowly rounded posteriorly; with minute indistinct punctation.

- 234 Elytra elongate, with parallel sides, convex, more or less rounded individually at apex; with large punctation forming transverse striation, and short thin light-colored adherent hairs. Legs long; hind femora in male extend beyond apex of elytra, notably shorter in female. Entire body, elytra, antennae, and legs black. Sometimes antennal segments, commencing from 6th, with rusty ringlet at base. Length of body 5.0 to 6.5 mm.

Egg: White, elongate, rounded at one pole, produced or slightly pointed at the other. Chorion with dense acute cellular sculpture. Length 1.0 mm, width 0.3 mm.

Larva (Figure 136): Body ventrally flat, moderately bulges dorsally.

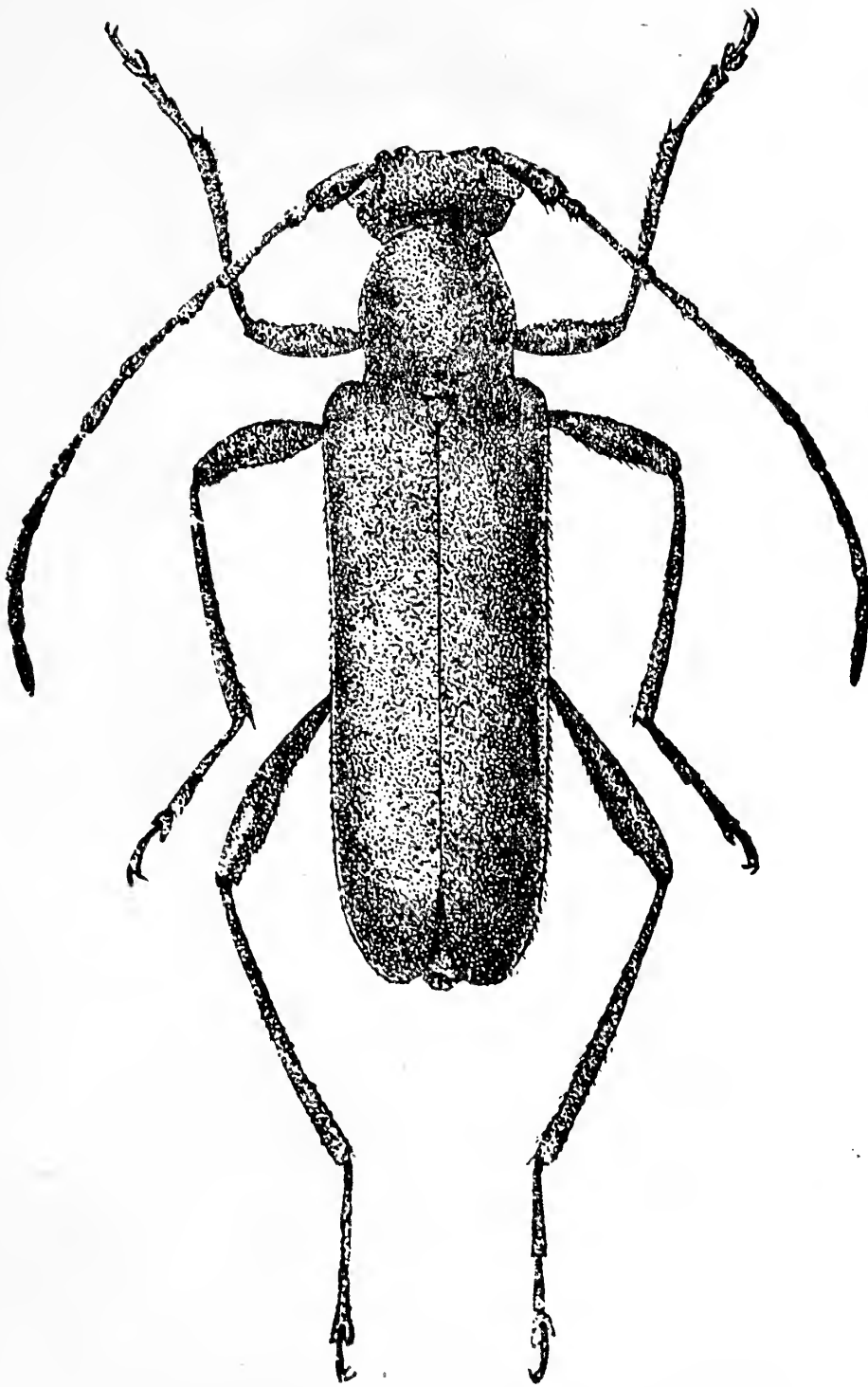


Figure 135. *Grammoptera gracilis* Brancs.

Head somewhat retracted into prothorax, flat, narrowly rounded anteriorly. Epistoma triangular, demarcated laterally by distinct whitish frontal sutures, divided in lower half by distinct brownish longitudinal suture, without perceptible transverse white band. Hypostoma trapezoidal, distinctly narrows anteriorly, demarcated laterally by sutures, with narrow white median band, and without setae. Three black pigmented ocelli laterally on each side of head at antennal base.

235 Pronotum flat, transverse, length slightly more than 0.33 width, with indistinct grooved lateral dents extending forward from posterior angles

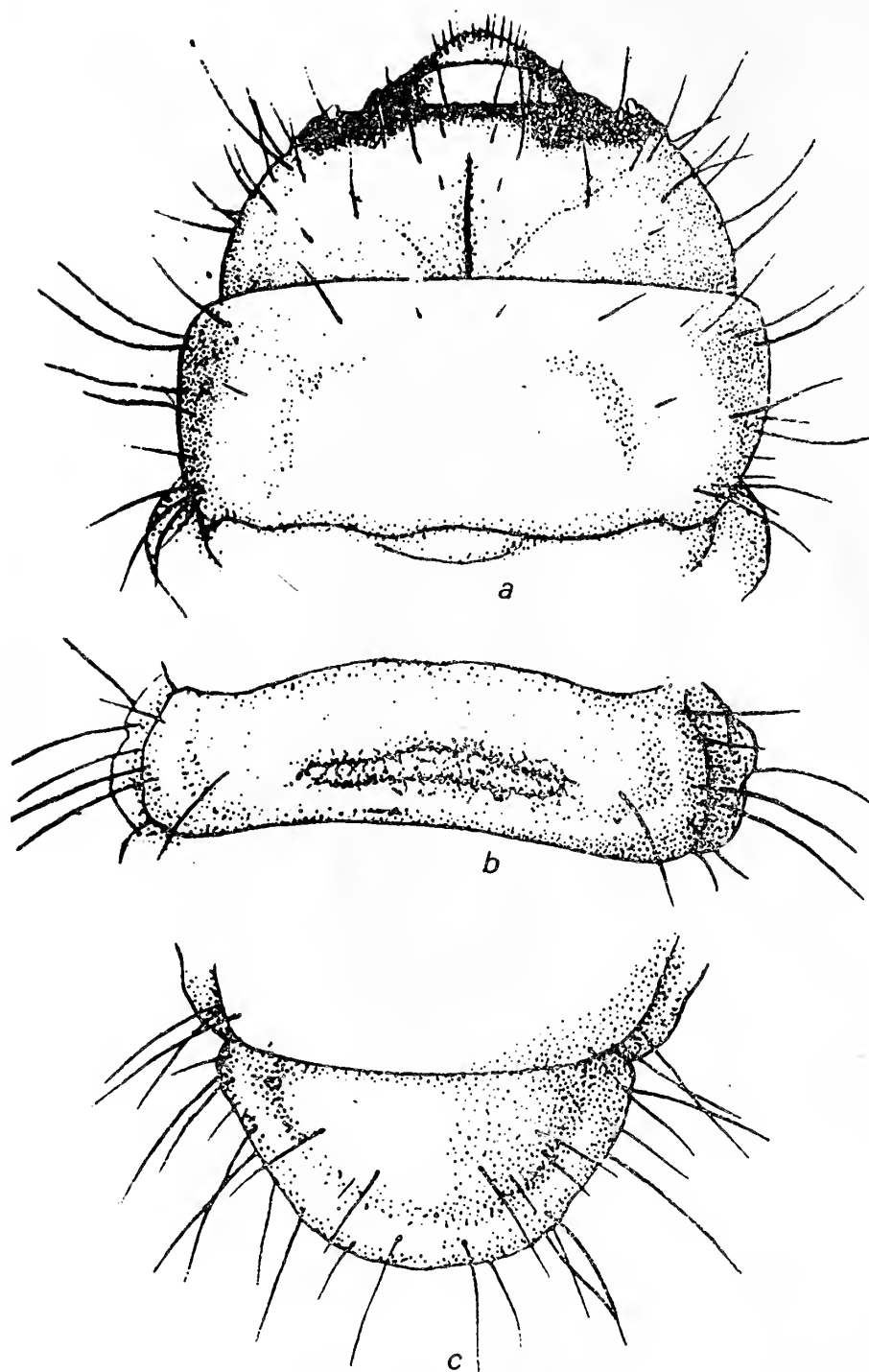


Figure 136. Larva of *Grammoptera gracilis* Brancs.
 a—head and pronotum; b—abdominal tergite IV with
 locomotory ampulla; c—abdominal tergite IX.

and sloping toward middle, with long sparse hairs laterally. Prosternum, anterior to eusternum, with stray setaceous hairs (up to 10 in number) forming distinct transverse row. Eusternum convex, lustrous, with indistinct stray setae laterally. Thoracic legs comparatively thick, short, with brownish and somewhat curved claws.

Abdomen gradually narrows posteriorly, with thin sparse hairs laterally, and distinct locomotory ampullae on segments I to VII. Abdominal tergites smooth on disk; dorsal locomotory ampullae divided by two transverse grooves, and with minute indistinct granules. Abdominal

tergite IX gently rounded on posterior margin, laterally bound by carina, bulges on disk, medially with four long hairs forming transverse row. Sternite IX with six setaceous hairs on posterior margin forming transverse row. Body white, head reddish-rust, anterior margin of epistoma black, mandibles reddish-brown. Length of body up to 7.0 mm, width of head 1.5 mm.

Pupa (Figure 137): Head broad, transversely impressed behind antennal bases and at clypeus, with broad median longitudinal groove between antennae; large setae along sides of frons (three on each side) from inner side of antennae form two oblique rows that converge slightly posteriorly; six setae on anterior margin at base of clypeus form transverse row, somewhat curved posteriorly; and eight to ten setae form transverse band at level of posterior lobes of eyes. Antennae curved, annular in second half.

Pronotum convex, produced at posterior angles, narrows somewhat anteriorly, smooth on posterior half of disk; long setae laterally and in

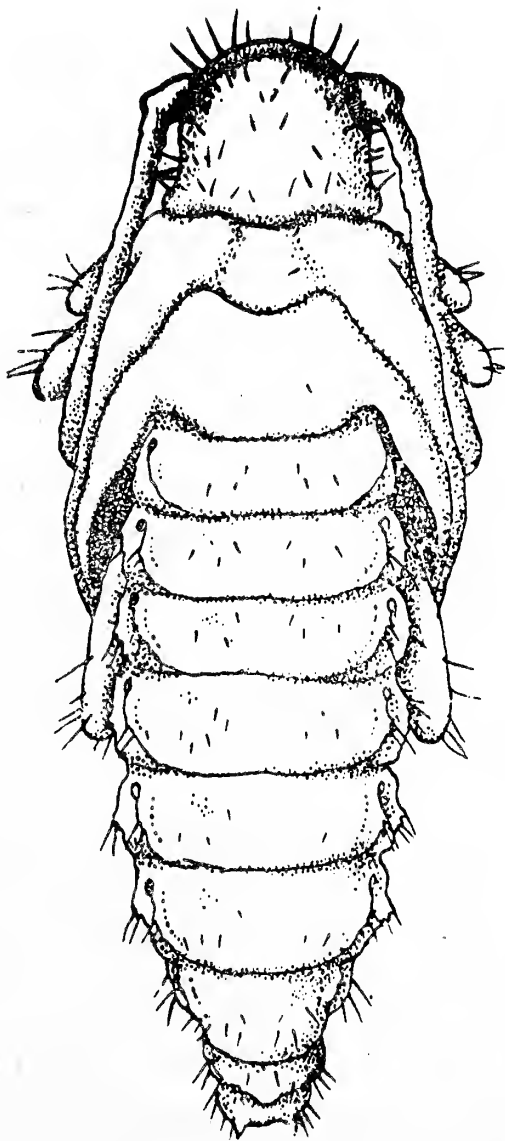


Figure 137. Pupa of *Grammoptera gracilis* Brancs.

anterior half, and large widely separated setae forming transverse row at base. Posterior half of mesonotum with one pair, metanotum two pairs of widely separated setaceous spinules mediolaterally and on posterior half of disk.

Abdomen broadens in region of segments III to V, narrows anteriorly and posteriorly. Abdominal tergites convex, with median longitudinal groove, in posterior half with two to three acicular paramedial setae in transverse row. Pleural tubercles with three to four long setae directed backward. Tip of abdomen (ventral view) obtuse, bound by horseshoe-shaped carina set with long thin setae, with pair of widely separated pointed urogomphi sclerotized terminally. Valvifers of female large, produced into lateral papilliform process apically. Length 5.0 to 6.5 mm, width of abdomen 1.5 to 1.9 mm.

Material: Ussuri-Primor'e region, Komarovka River; large number of beetles including 99 raised in the laboratory, larvae 20, larval exuviae from cells with beetles and pupae (four males, five females).

Distribution: Ussuri-Primor'e region (mountain-taiga habitat, Komarovka River, and Semenov Spring).

Biology: Inhabits broad-leaved forests. Flight of beetles observed from end of May through July. Beetles mate soon after emerging from cells. Female usually lays eggs singly, rarely in batches of two to three in bark crevices, at base of buds, and on shoots up to 2.0 to 4.0 cm in diameter. Fecundity of female comparatively low. One female, which had not yet begun oviposition, was dissected seven days after emerging from wood, and eight mature eggs were found in the ovaries. Larvae hatch from eggs at 18 to 20°C in two to three weeks (average 18.1 days) after oviposition.

Young larvae bore into bark and make longitudinal meandering galleries under it, plugging them with fibrous frass. Galleries more or less impressed on alburnum, irregular, sometimes broaden, sometimes narrow. Mature larvae make oval pupal cell along shoot in upper wood layer (under bark) or in bark, spread coarse fibrous frass along its sides, then pupate. Sometimes before pupation larvae nibble an exit and plug it densely with frass.

Length of pupal cell 7.0 to 9.0 mm, width 3.0 to 4.0 mm. Larvae pupate after second hibernation. Earliest pupae seen in May and last mid-June. At room temperature pupae develop in about two weeks. Developed beetles nibble round opening up to 1.5 mm in diameter on bark surface and exit through it. Weight of larvae before pupation in cells 7.3 to 14.2 mg, pupae 7.2 to 12.2 mg, and young beetles 5.1 to 9.7 mg. Some larvae, which had not yet prepared for pupation, weighed 21 mg. During prepupal period larvae lose up to 25% of their weight.

Grammoptera gracilis Brancs. mainly lives on the spindle-tree. For

example, in 1972 beetles were recovered from shoots in nature as follows: spindle-tree (*Euonymus*) 50, snowball tree or guelder rose (*Viburnum*) five, linden (*Tilia*) five, cork tree (*Phellodendron*) two, *Maackia* four, and ash (*Fraxinus*), pear (*Pyrus*), apple (*Malus*), walnut (*Juglans*), and hornbeam (*Carpinus*) one each. On one occasion six beetles were recovered from a shoot of spindle-tree 39 cm long and 2.0 cm in diameter. *Xylariopsis mimica* Bat. is often seen together with this species on spindle-tree.

2. *Grammoptera erythropus* (Gebler)

Gebler, 1841, *Bull. Soc. Nat. Moscou*, vol. 14, p. 612 (*Leptura*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 296-297.

Adult: Distinguished by broadened pronotum in anterior half, rusty legs, and other features. Body comparatively broad. Head short, flat between upper lobes of eyes, bulges tubercularly at antennal bases, with median longitudinal groove, minute dense punctation and semiadherent hairs. Genae short, temples rounded. Antennae notably thicken from 5th segment to apex, matte, more lustrous basally; apices of antennae reach beyond 0.50 or 0.75 length of elytra. Third antennal segment considerably shorter than 1st, equal to 4th or 5th.

Pronotum bulges uniformly, markedly compressed laterally in posterior half, broadly rounded in anterior half, with dense deep punctation, semiadherent hairs, short longitudinal band impressed transversely at base in middle of hind clivus, medially with raised posterior margin. and slightly produced at posterior angles.

Elytra broad, bulge, individually rounded posteriorly; with slightly projecting humeri, deep punctation and light-colored semiadherent hairs. Spaces between punctures shagreen. Legs massive. Femora thicken apically. Hind tarsi somewhat longer than tibiae. First segment of hind tarsi notably shorter than two successive together. Body ventrally with dense golden hairs. Body black. Legs and mouthparts red, apices of femora black (*G. e. erythropus* Gebler.). Antennae dark brown or almost entirely red. First segment and sometimes subsequent segments of antennae light rust. Tip of abdomen with rusty tinge (*G. e. ingrlica* Baekm.). Body length of male and female 7.0 to 8.0 mm.

Distribution: Altai, the southern Urals, and Europe. Type form inhabits Altai, *G. e. ingrlica* Baekm. the southern Urals and the European part of the USSR. The latter is ecologically associated with deciduous species. Flight of beetles occurs from end of May through July.

238 3. *Grammoptera coerulea* Jurec.

Jurecek, 1933, *Acta Soc. Entom. Cechosl.*, vol. 30, p. 128; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 301-302.

Adult: Body black and short, up to 5.0 mm in length. Head and pronotum matte. Apices of antennae reach middle of elytra. Pronotum with minute punctation, minute adherent hairs, and short smooth median longitudinal groove. Elytra bluish-green with metallic sheen, moderately elongate, individually rounded apically, finely punctate, with tender sparse hairs.

Distribution: Known from Ussuri-Primor'e region. Not found in other places. Biology not definitively known.

3. Genus *Allosterna* Muls.

Mulsant, 1863, *Coleopt. France, Longicorn*, 2nd ed., p. 576 (*Allosterna*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 302-303; Gressit, 1951, *Longicorn Beetles of China*, vol. 2, p. 79 (*Allosterna*).

Adult: Body narrow and elongate. Head short, comparatively broad between antennae. Genae well developed, somewhat wider than long. Temples suspended, produced riblike; if rounded, cervix lustrous, with only stray punctation. Elytra individually rounded apically, taper more at inner angles.

Egg: Lustrous, without cellular sculpture.

Larva: Head slightly flattened dorsoventrally, with pigmented ocellus laterally at base of antennae. Abdomen not flat, bulges dorsally. Dorsal locomotory ampullae occur on tergites I to VI and ventral locomotory ampullae on abdominal sternites I to VII.

Pupa: Body elongate. Head considerably shortened in front of eyes, antennae bent, annular in second half. Pronotum bulges, with long setae forming small transverse row on anterior and posterior margins. Abdominal tergites bulge, usually with paired long setae. Tip of abdomen with pair of more or less developed urogomphi dorsally.

Not more than three species are known in the fauna of northern Asia. *Allosterna chalybeella* (Bat.), formerly placed in the genus *Grammoptera*, belongs to this genus on the basis of morphological features of the preimaginal stages.

Type species: *Leptura tabacicolor* De Geer, 1775.

KEY TO SPECIES

Adult Insects

- 1 (2). Elytra entirely or partly reddish-rust. If elytra highly darkened, tip of abdomen invariably red. . . . 1. *A. tabacicolor* (Deg.).
- 2 (1). Elytra black. If disk of elytra with translucent rusty band, tip of abdomen black.

- 3 (4). Fore- and midlegs more or less light yellow, tarsi and mid-tibiae dark brown. 2. **A. elegantula** (Kr.).
 4 (3). Only forelegs rusty-yellow, mid- and hind legs dark brown. 3. **A. chalybeella** (Bat.)

Larvae

- 1 (4). Body laterally with sparse hairs. Abdominal tergite IX basally smooth, with sparse stray hairs in posterior half.
 2 (3). Abdominal tergite IX narrows in posterior half, projects, produced apically, narrowly rounded posteriorly, and appears somewhat emarginate laterally. 1. **A. tabacicolor** (Deg.).
 3 (2). Abdominal tergite IX narrows uniformly in posterior half, not produced apically, broadly rounded posteriorly, not emarginate laterally. 2. **A. elegantula** (Kr.).
 4 (1). Body laterally with dense hairs. Abdominal tergite IX basally and posteriorly with dense hairs. . . . 3. **A. chalybeella** (Bat.).

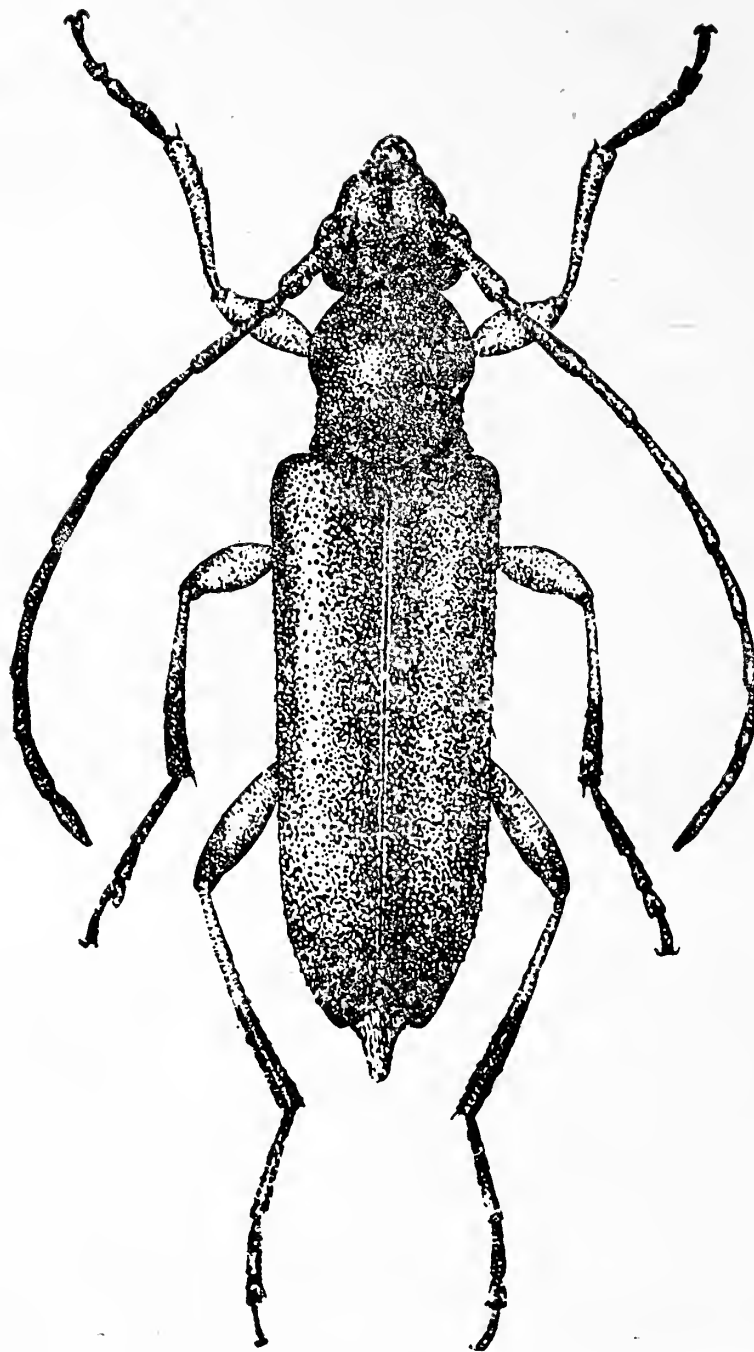
Pupae

- 1 (2). Urogomphi on tip of abdomen long, sclerotized, spinescent terminally. 1. **A. tabacicolor** (Deg.).
 2 (1). Urogomphi on tip of abdomen short, poorly developed, sometimes barely visible (female).
 3 (4). Paired setae on mesonotum thin and piliform. Abdomen narrowly elongate. 2. **A. elegantula** (Kr.).
 4 (3). Paired setae on mesonotum thick and acicular. Abdomen broader, less elongate. 3. **A. chalybeella** (Bat.).

1. **Allosterna tabacicolor** (Deg.)

De Geer, 1775, *Mem. Ins.*, vol. 5, p. 139 (*Leptura*); *bivittis*, Motschulsky, 1860, *Schrenks Reisen Amurlande*, p. 146 (*Grammoptera*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 304–307; Gressitt, 1951, *Longicorn Beetles of China*, vol. 2, pp. 79–80; Kojima and Hayashi, 1969, *Insect Life in Japan*, vol. 1, p. 24.

Adult (Figure 138): Body moderately elongate. Head insignificantly produced in front of antennae, with sharp cervix behind, short and projecting temples; with dense punctation, smooth median longitudinal suture between antennae, hairs light colored. Genae well developed, almost 0.50 width of upper lobe of eye. Antennae long, with apices reaching 0.66 length of elytra (female) or almost to elytral apex (male). Third antennal segment shorter than 1st or equal to it, notably longer than 4th.



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Figure 138. *Allosterna tabacicolor* (Deg.), ab. *bivittis* Motsch.

Pronotum bulges uniformly, with dense uniform punctation, adherent, sometimes well-developed dense hairs, with or without smooth longitudinal line in middle of hind clivus, notably compressed ventrolaterally in posterior half; with faint transverse dent at base. Scutellum triangular, somewhat elongate, pointed posteriorly, and covered with tender grayish fluffy hairs. Elytra long, elongate, with parallel sides, individually rounded apically, taper more at inner angles; with large punctation and light-colored yellowish adherent hairs.

Abdomen with gray or yellowish adherent hairs, bent downward at tip. Legs long and slender; hind femora do not reach apex of elytra, somewhat longer than tibiae or equal to them. First segment of hind tarsi considerably longer than successive ones together. Body black; ely-

tra and legs light rust; antennae brownish, with rusty tone (*f. typica*). Often elytra more or less blackened, tip of abdomen reddish, antennae dark brown with reddish-rust 1st and 2nd segments (*ab. bivittis* Motsch.). Coloration highly variable. Body length of male and female 6.0 to 9.5 mm.

Egg: White, elongate, rounded at poles; chorion lustrous, smooth, without perceptible sculpture. Length 1.0 to 1.1 mm, width 0.3 to 0.4 mm.

Larva (Figure 139): Head slightly retracted into prothorax, with almost parallel sides. Epistoma bulges insignificantly, with distinct white frontal sutures laterally, medially divided by longitudinal suture, darkened only in posterior half, with numerous long piliform setae in anterior half, with lustrous dark rusty border on anterior margin, and deep narrow notch at angles. Hypostoma narrows somewhat anteriorly, 4.0 times wider at base than long, lustrous, without setae, yellow toned, with rusty border on anterior and posterior margin widely interrupted medially. Sides of cephalic capsule, at base of antennae, with one large pigmented ocellus each. Clypeus broad, lustrous, more light colored on disk, and rusty laterally. Labrum transversely oval, on anterior margin with thin setae, lustrous at base. Mandibles reddish-rust, comparatively broad, obliquely and broadly notched at apex, with subulate produced lower denticle.

Pronotum transverse, bulges slightly on disk; with numerous long hairs laterally, and tender hairs forming transverse row in anterior half. Pronotal shield without lateral longitudinal folds, sometimes with stray setae forming transverse row at base. Prosternum with dense long hairs.

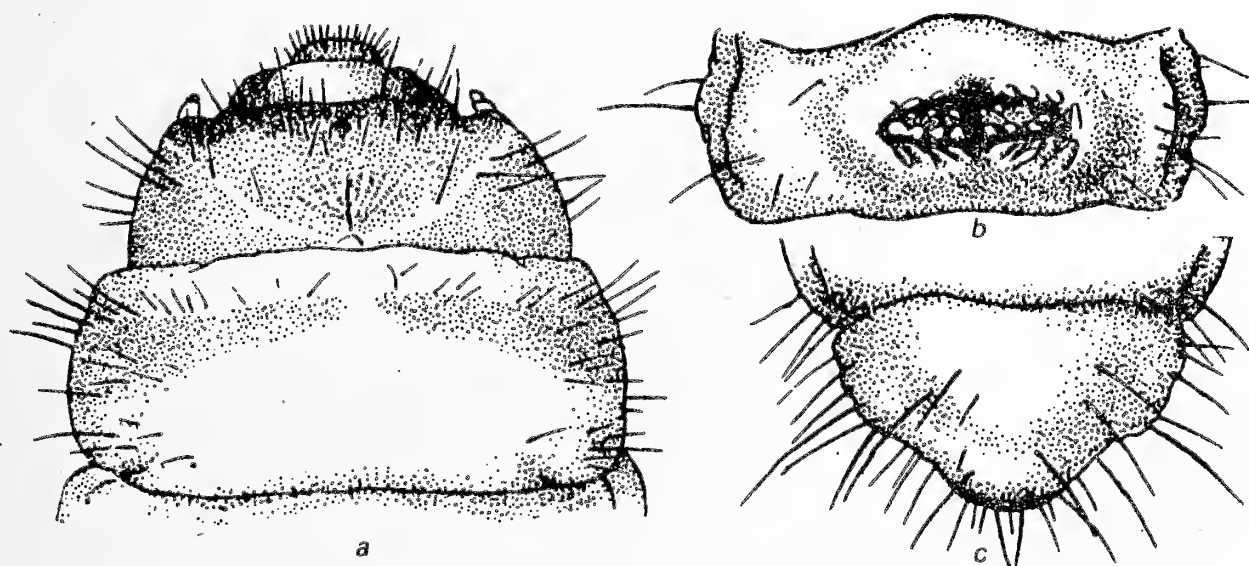


Figure 139. Larva of *Allosterna tabacicolor* (Deg.).

a—head and pronotum; b—abdominl tergite with locomotory ampulla;
c—tip of abdomen.

Eusternum convex, with four long piliform setae along margin in anterior half. Thoracic legs comparatively long, with acute, slightly curved brownish claws.

Abdomen moderately elongate, narrows posteriorly, with sparse long hairs laterally. Abdominal tergites elongate, with median longitudinal groove, smooth on disk, without hairs. Dorsal locomotory ampullae on first six abdominal tergites divided by two transverse grooves; with minute lustrous granules. Ventral locomotory ampullae on first seven abdominal sternites divided by transverse groove, with granules forming two transverse rows. Abdominal tergite IX convex, markedly narrows angularly in posterior half, somewhat produced and narrowly rounded at posterior margin, with sparse stray setaceous hairs. Body white. Anterior margin of pronotum with broad yellow band. Head rusty-yellow, brownish-black on anterior margin of epistoma. Length of body 8.0 to 12.0 mm, width of head 1.5 mm.

Pupa (Figure 140): Body elongate. Head produced in front of antennae, bent under; with pair of long setae along sides of frons at antennae, one seta in front of antennae, and two pairs of setae on 241 anterior margin of frons at base of clypeus. Eyes posterolaterally bulge tubercularly, with one or two setae here. Antennae annular.

Pronotum bulges, narrowly rounded anteriorly, distinctly produced at posterior angles (male) or almost not produced (female); with long setae forming transverse row at base, small tuft of setae on anterior margin, and sparse field on disk and sides. One or two setae along sides of mesonotum. Metanotum with tuft of four (female) or several setae (male).

Abdomen broadens at segments III to IV, narrows anteriorly and posteriorly. Abdominal tergites bulge, with long setae set in pairs forming transverse row. Tip of abdomen terminally obtuse (ventral view), bound laterally by faint carina set with long setae; with pair of long (male) or short and minute (female) urogomphi dorsally, turned upward, set with acute sclerotized spinule (male). Abdominal sternites V to VI usually with two pairs of long thick setae. Valvifers of female large, contiguous, produced laterally at apex into papilliform process. Length 7.0 to 9.0 mm, width of abdomen up to 2.0 mm.

Material: Many beetles (21) and pupae (five males and three females) raised from larvae (Kunashir, 1974); larvae raised from eggs laid by females on larch cuttings in the laboratory (Tuva, 1976). Total of 329 beetles collected in nature also studied.

Distribution: From Atlantic to Pacific Ocean coasts.

Biology: Inhabits deciduous and coniferous species, extending north to forest boundary, and in mountains to a height of 2,000 m above sea level. Beetles feed on flowers. Flight commences in June and ends early

August. Beetles maximum at end of June and in July. For example, in Altai of 289 beetles collected systematically in one season, 21.2% were found in the second half of June, 78.2%—July, and 0.6%—early August. High in the mountains (1,000 to 2,000 m) en masse flight completed in second half of July. Female lays eggs singly in bark crevices and in fissures of exposed wood of dead deciduous and coniferous trees. Larvae live in bark and in upper layer of wood, make longitudinal galleries, and plug them with fibrous (ground) frass. Length of gallery in wood 12 cm, width 4.0 to 5.0 mm.

242 In Kunashir larvae found in bark of thick-trunked decaying oak

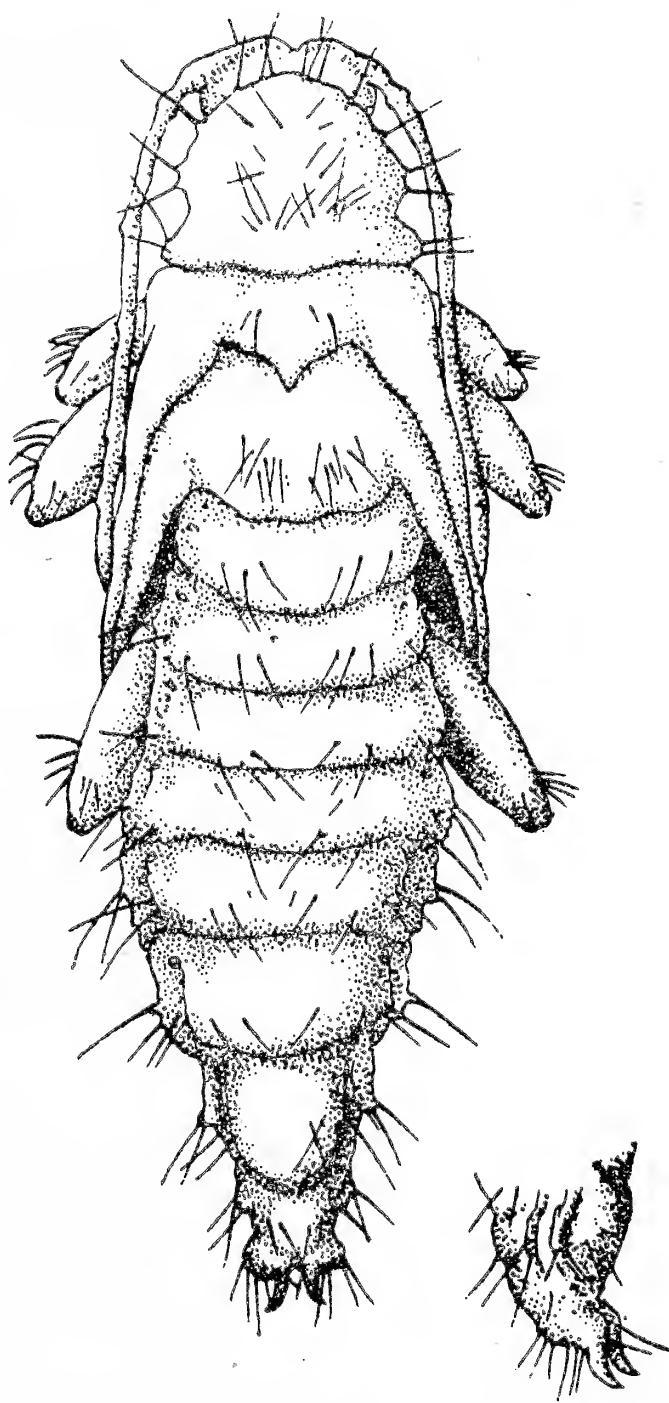


Figure 140. Pupa of *Allosterna tabacicolor* (Deg.), male.

(*Quercus*), *Kalopanax*, and elm (*Ulmus*). They make meandering, sometimes platformlike galleries. After second hibernation, in second half of May and in June, larva makes pupal cell, usually along trunk, and pupates in it. Length of cell 8.0 to 13.0 mm, width 4.0 to 5.0 mm.

Pupa lies with head upward in cell. Maximum pupae sighted in middle 10 days of June. Young beetles seen in June and early July. Before emerging from wood, young beetles nibble openings (1.5 mm × 2.5 mm) on bark surface. Emergence of beetles commences in middle 10 days of June and ends mid-July. Life cycle completed in two years.

2. *Allosterna elegantula* (Kr.)

Kraatz, 1879, *Deutsch. Entom. Z.*, vol. 23, pp. 105–106 (*Grammoptera*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 309; Gressitt, 1951; *Longicorn Beetles of China*, vol. 2, p. 79.

Adult (Figure 141): Characterized by rather small dimensions and elongate body. Head broad, bulges at base of antennae on inner side, rounded on occiput; with dense uniform punctation, distinct narrow smooth longitudinal band anteriorly, with light-colored yellowish hairs. Temples project, short; genae slightly longer or not longer than temples. Antennae long and thin, with apices reaching posterior end of elytra (male) or slightly shorter (female). Third antennal segment equal to 1st, slightly shorter or not shorter than 5th, but considerably longer than 4th.

Pronotum convex, with parallel sides, and posterior angles slightly produced laterally; with dense uniform punctation, yellowish adherent hairs, sometimes with distinct longitudinal dashlike band medially on hind clivus. Scutellum elongate, triangular, narrowly rounded, finely punctate, with minute yellowish hairs. Elytra elongate, parallel, individually rounded apically, taper more on inner angles; with moderately dense punctation and yellowish or gray semiadherent hairs. Legs slender, comparatively short; hind femora do not reach elytral apex. Hind tarsi not shorter than tibiae. First segment of hind tarsi 2.0 times longer than two successive ones together.

Abdomen with dense notchlike punctation and short light-colored hairs that do not form compact cover. Body, elytra, legs (except forelegs), and antennae black or brownish-black. Forelegs, often femora
243 of midlegs reddish-yellow. First antennal segment sometimes rusty. Rarely, elytral disk with longitudinal rusty band. Length of body of male and female 5.0 to 6.0 mm.

Egg: White, gradually but insignificantly narrows toward one pole, rounded at both ends. Chorion smooth, lustrous, without cellular sculpture. Length 0.9 mm, width 0.3 mm.

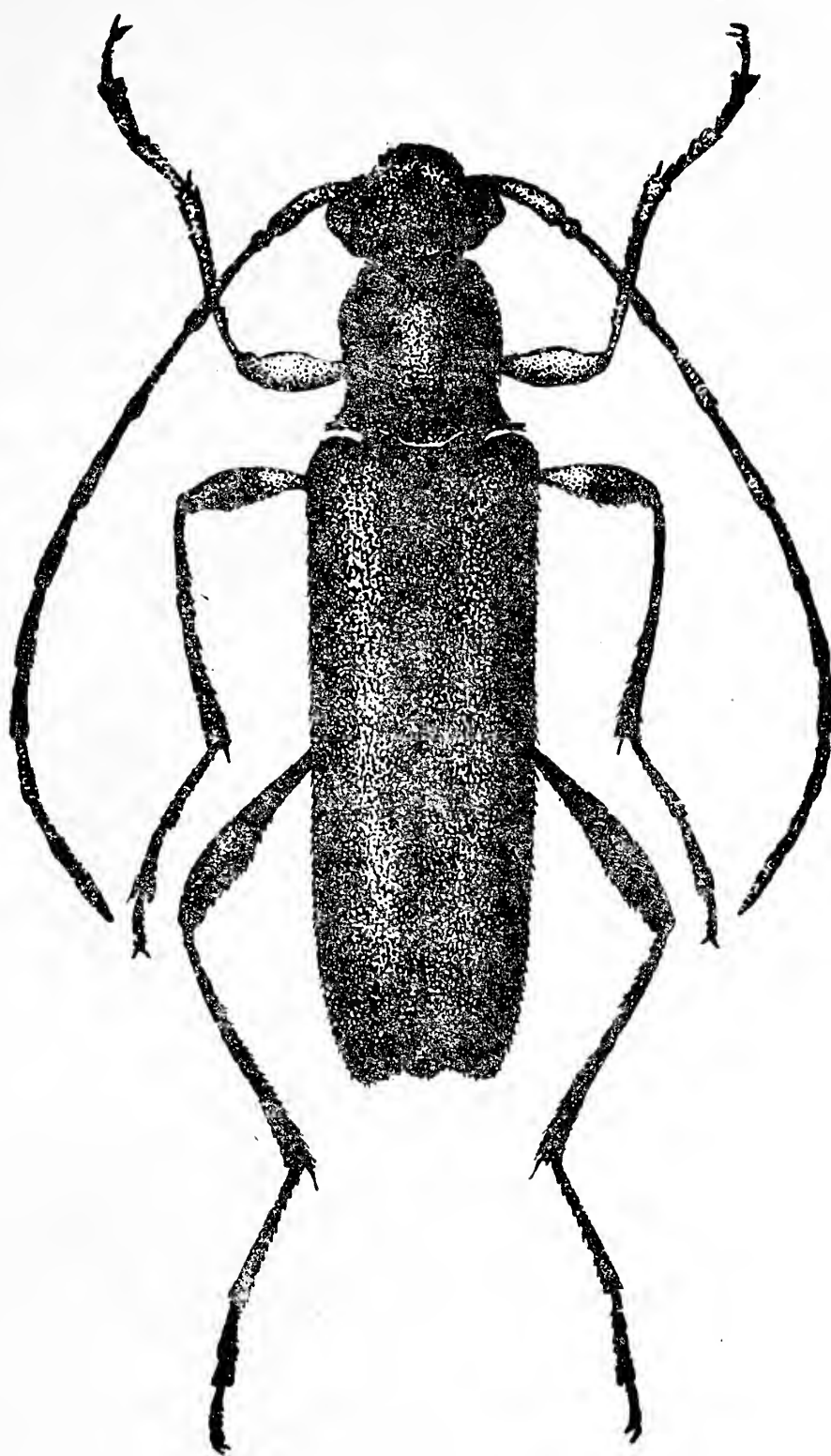


Figure 141. *Allosterna elegantula* (Kr.).

Larva (Figure 142): Very similar to larva of *Allosterna tabacicolor* (Deg.). Differs in wide abdominal tergite IX less produced at posterior margin, and other features. Parietals slightly rounded, almost parallel, with distinct pigmented ocellus on anterior margin at base of antennae. Anterior margin of epistoma even, with lustrous dark red or dark rusty smooth (without hairs) border, and behind it many long setaceous hairs encircled basally by small sclerotized ring. Epistoma laterally bound by white, sometimes faint, frontal sutures, and medially divided by longitu-

dinal suture of distinct brownish tone only apically. Hypostoma insignificantly narrows anteriorly, 4.0 times wider than medial length, straightly truncate on anterior margin, with reddish-rusty border narrowly interrupted medially, and emarginate posteriorly.

Pronotal shield white, bulges slightly, without lateral longitudinal folds. Prothoracic presternum with long dense hairs; propresternum with two to four indistinct hairs forming transverse row. Eusternum convex, with four barely perceptible hairs along sides, of which two long and two short. Thoracic legs with long acute, strongly curved claws.

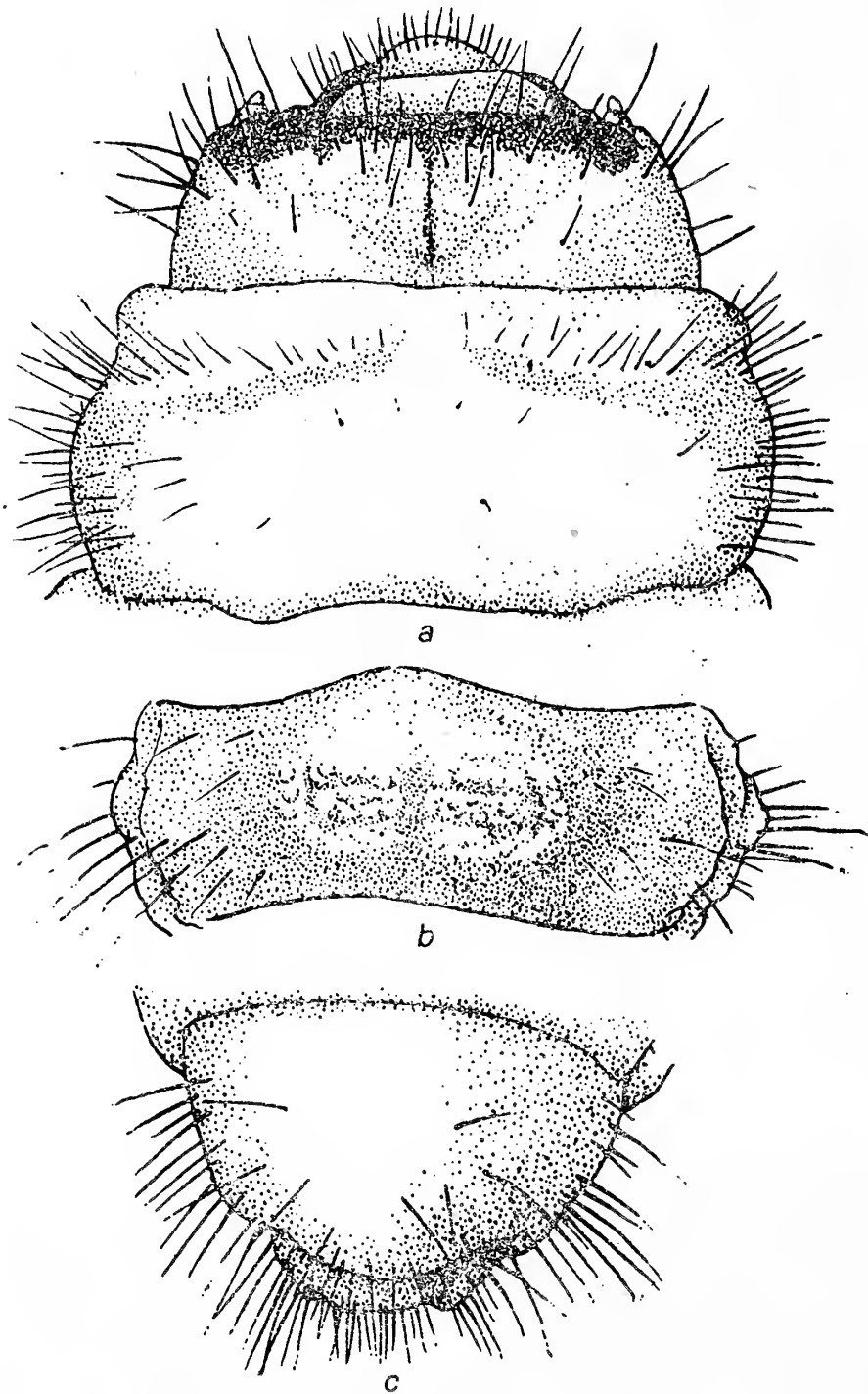


Figure 142. Larva of *Allosterna elegantula* (Kr.).

a—head and pronotum; b—abdominal tergite with locomotory ampulla;
c—tip of abdomen.

Abdomen moderately elongate, pleural tubercles with long thin hairs. Abdominal tergites convex, smooth on disk, with stray hairs laterally. Dorsal locomotory ampullae developed on first six abdominal tergites, divided by two transverse grooves, with minute granules not forming distinct transverse rows. Ventral locomotory ampullae on first seven abdominal sternites, with two rows of granules. Tergite VII smooth, lustrous, without locomotory ampullae. Tergite IX broad, broadly rounded posteriorly, not produced at posterior margin, without perceptible notches laterally. Body white. Head yellowish-rust, dorsal side of anterior margin dark rust or brownish-rust. Pronotum anteriorly with yellowish transverse band extending to sides. Length of body 7.0 to 8.0 mm, width of head 1.1 mm.

245 *Pupa* (Figure 143): Well distinguished by small contiguous urogomphi. Body slender, elongate. Head short, with folds behind antennal

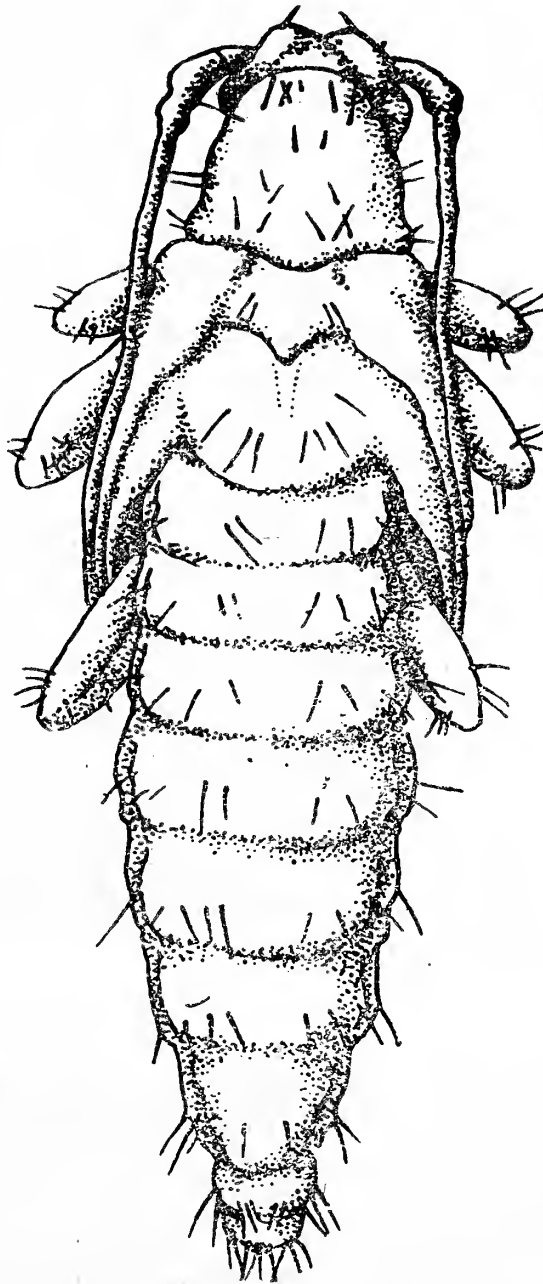


Figure 143. Pupa of *Allosterna elegantula* (Kr.).

bases obliquely diverging laterally; three long setae on inner side of antennal socket, pair of setae laterally at base of clypeus, and one large seta posteriorly in region of occipital tubercles. Antennae annular in second half.

Pronotum slightly narrows anteriorly, bulges, usually with eight setae each on anterior margin and produced base, forming more or less distinct transverse row; with sparse (stray) setae on disk and sides. Mesonotum usually with one to two pairs of widely separated setae. Metanotum with four to seven paramedial setae forming tufts that extend toward anterior angles.

Abdomen slender, narrows anteriorly and posteriorly, with faint median longitudinal groove. Abdominal tergites convex, with three long paramedial setae on slightly protuberant base in posterior half. Abdominal sternites V to VI laterally with one to two thin setae directed toward middle. Tip of abdomen obtuse, laterally bound by slightly projecting carinae set with five setae each on papilliform base. Valvifers of female large and hemispherical, produced laterally at apex. Length of body up to 7.0 mm, width of abdomen 1.8 mm.

Material: Collected in Kunashir. Adult insects 22, larvae 39, pupae—five males and three females.

Distribution: Southeast Siberia (mainly Ussuri-Primor'e region), Sakhalin, Kunashir; Japan (Hokkaido), northeast China, and North Korea. I found it only in Kunashir and not in other regions.

Biology: Inhabits broad-leaved forests. Beetles sighted from June up to first half of August inclusive. They feed on flowers. Female lays eggs in bark crevices of viable liana of *Actinidia* ranging in diameter from 4.0 to 10.0 cm. Larvae make meandering galleries in bark without affecting bast. They live very well between separated bark layers. Found in bark of liana at lower and middle levels at a height of up to 3.0 to 4.0 m. Larvae pupate end of May and in first half of June. Beetles emerge from pupal cells with developed gonads in second half of June and early July. Ovaries of one female contained 26 mature eggs. Weight of larvae ready for pupation 7.5 to 13.9 mg (average 11.1 mg), pupae 7.0 to 13.0 mg (average 10.3 mg), and young beetles before emerging from wood 5.0 to 8.7 mg (average 6.4 mg).

246 3. *Allosterna chalybeella* (Bat.)

Bates, 1884, *J. Linn. Soc. Lond. Zool.*, vol. 18, p. 216 (*Grammoptera*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 298–299 (*Grammoptera*); Gressitt, 1951, *Longicorn Beetles of China*, vol. 2, p. 78 (*Grammoptera*); Mamaev and Danilevskii, 1975, *Lichinki zhukov-drovosekov*, pp. 129–130.

Adult (Figure 144): Similar to *Grammoptera gracilis* Brancs. Differs in light-colored rusty forelegs, more distinct hair cover on pronotum,

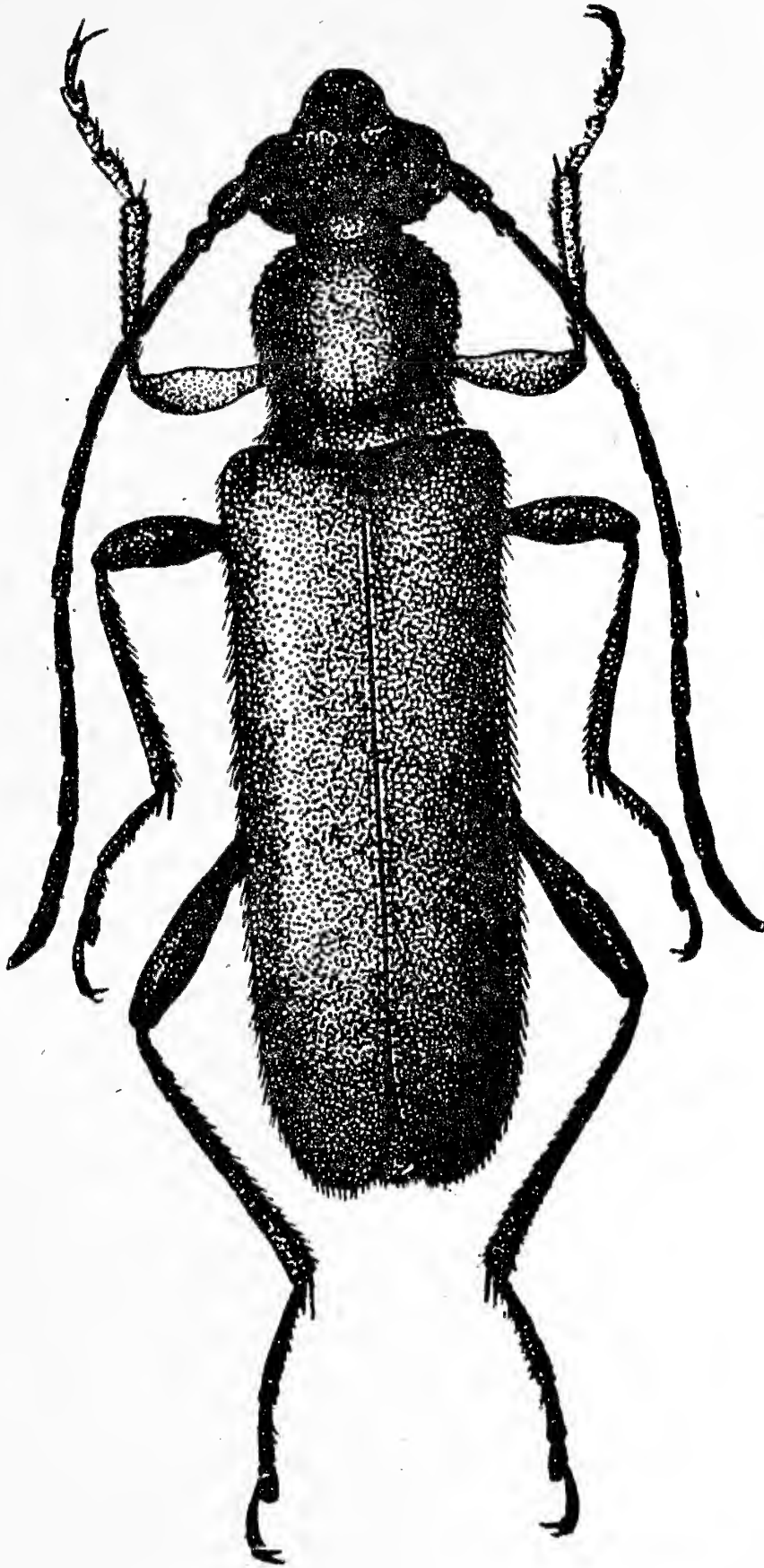


Figure 144. *Allosterna chalybeella* (Bat.).

and other features. Head broad, short in front of antennae, not elongate; with dense large punctation, light-colored hairs projecting on temples, narrow median longitudinal suture between antennae, and short rounded temples. Antennae comparatively long, thicken somewhat apically, reach beyond middle (female) or up to hind clivus of elytra (male). Eleventh antennal segment elongate, acutely acicular at tip.

Pronotum rather convex, broadens somewhat anteriorly, rounded at anterior angles, produced at posterior ones, and somewhat compressed from sides in posterior half; with distinct dense, rather large punctation, longitudinal narrow band in some specimens medially, and adherent, sometimes long, light-colored hairs.

Elytra bulge, with parallel sides, rounded individually at apex, slightly obtuse; with dense rugose punctation and light-colored adherent hairs. Body black. Apex of mandibles, labrum, and palpi yellow. Hind legs black, forelegs rusty-red. Antennae dark brown, first two antennal segments often brownish-rust. Length of body 6.0 to 8.0 mm.

Larva (Figure 145): Differs from larvae of the genus *Grammoptera* in dorsal locomotory ampullae present only on first six abdominal tergites. Head appears thick, somewhat flattened dorsoventrally. Epistoma insignificantly flattened, whitish, with dark brown border on anterior margin, diffuse frontal sutures laterally, longitudinal brownish suture medially, less prominent brownish border on posterior margin, and very dense long setae in anterior half. Hypostoma insignificantly narrows anteriorly, with rounded anterior angles, and white median longitudinal band. Clypeus short, broad, yellowish. Labrum transversely oval, broadly rounded on anterior margin, with dense thin setae. Mandibles broad and massive, widely notched apically, with projecting dorsal and ventral denticles.

Pronotum convex; with very dense long hairs in anterior half and laterally. Pronotal shield coriaceous and white, without lateral longitudinal folds, with short setae at base forming transverse row. Prosternum in presternal and eusternal regions with very dense long hairs.

Abdomen comparatively thick, with long thin hairs laterally. Dorsal locomotory ampullae developed on abdominal tergites I to VI, divided by two transverse grooves, and with minute granules. Tergite IX convex, elongate, narrowly rounded posteriorly, and almost entirely covered with hairs. Ventral locomotory ampullae on abdominal sternites I to VII, with two rows of minute granules. Sternite IX basally smooth, with long hairs in posterior half. Body white. Head laterally and ventrally rusty-yellow, with dark brown or dark rust border on anterior margin, and pale yellow transverse band on anterior margin of pronotum. Length of body 10 to 12 mm, width of head 2.0 mm.

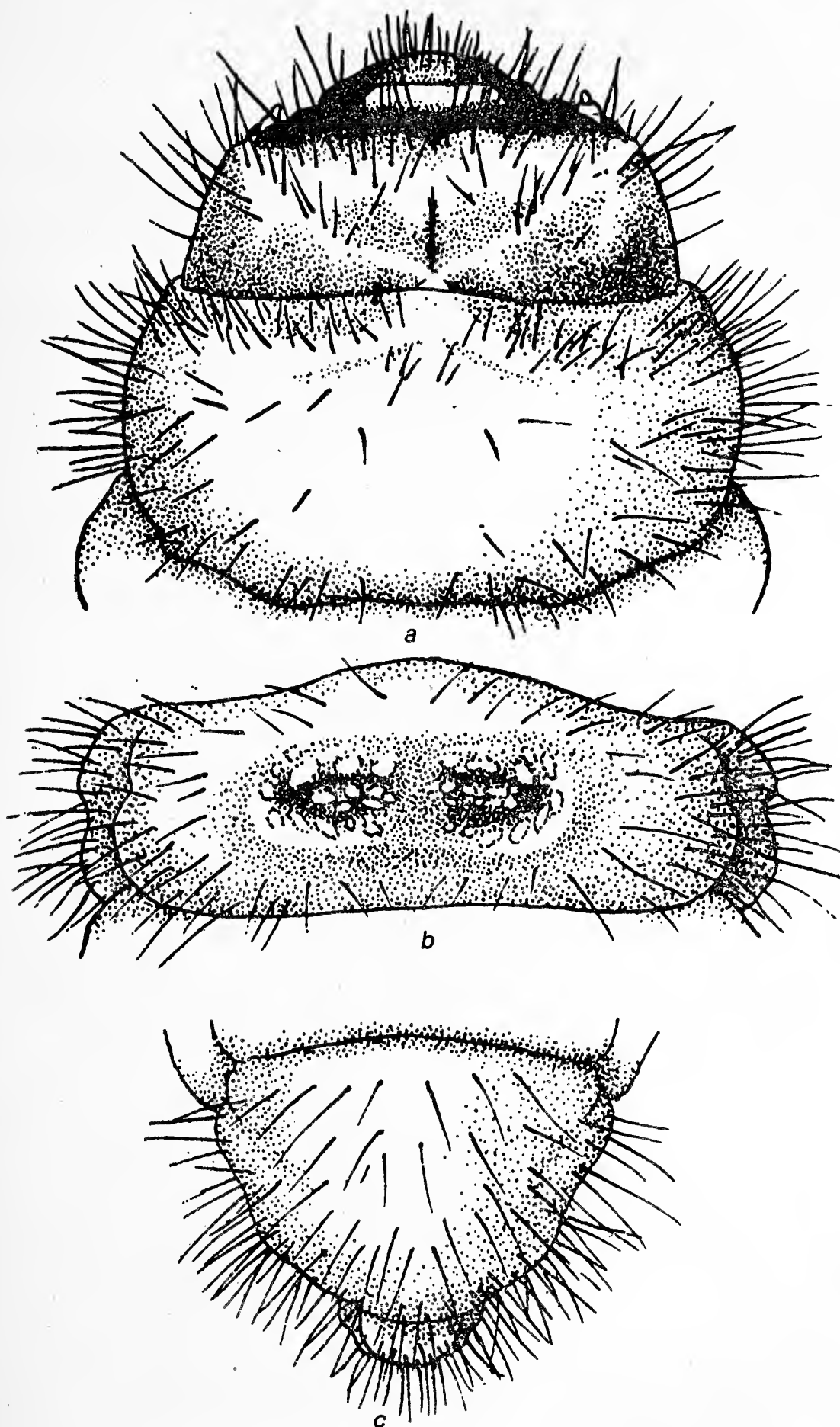


Figure 145. Larva of *Allosterna chalybeella* (Bat.).
a—head and pronotum; b—abdominal tergite with locomotory ampulla;
c—tip of abdomen.

Pupa: Body elongate. Head moderately bent under. Pronotum convex, with group of setae forming transverse band or row on anterior margin and at base. Posterior angles of pronotum slightly produced. Mesonotum with pair of large widely separated setae. Metanotum with rather short, comparatively thick setae forming two tufts of five to seven setae each. Tip of abdomen obtuse, laterally (ventral view) with carinae bearing long thin setae, and with small contiguous urogomphi dorsally. Length up to 9.0 mm.

Taxonomic remarks: This species was formerly placed in the genus *Grammoptera*. However, it belongs to the genus *Allosterna* on the basis of many morphological characteristics of the adult, and especially the presence of dorsal and ventral locomotory ampullae on the first six and seven abdominal segments respectively in the larva.

Material: Ussuri region, mountain-taiga habitat, 17 males and females, collected in May and June, 1970. Komarovka River, 10 males and females, collected in June and July, 1972 and 1973; same, six larvae, one dead pupa, and several larval exuviae from pupal cells with beetles.

Distribution: Ussuri-Primor'e region, southern Sakhalin, Kurils; northern Japan. Place of occurrence in Primor'e: mountain-taiga, maple ravine, Ovchinnikovo, Partizan, Osinniki, and Lake Khanka.

Biology: Inhabits deciduous and mixed vegetation. Flight of beetles commences in late May and ends in early August. With the onset of an early spring, beetles sighted en masse in last few days of May and early June. Sometimes they feed on flowers. Colonize oak, maple, fir, and spruce. Larvae live in upper layer of wood or dead trees and make longitudinal galleries. Beetles raised from larvae extracted from wood of oak, spruce, and fir. Pupation of larvae observed in May and partly in June. Beetles emerge from wood through flight openings up to 2.0 mm in diameter on bark surface.

4. Genus *Cornumutila* Letzn.

Letzner, 1843, *Arbeit. Schles. Gesel. Vaterl. Cult.*, p. 173; *Letzneria*, Kraatz, 1837, *Z. Entom. Bresl.*, 7, 2, 63; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 310-311; Gressitt, 1951, *Longicorn Beetles of China*, vol. 2, p. 76.

Adult: Characterized by elongate, not very flat body, short 3rd antennal segment, longitudinal white bands on elytra, and latter individually rounded apically.

Egg: Elongate, rounded at poles, with flat cellular sculpture.

Larva: Head not very flat, with single elongate ocellus laterally on anterior margin, medial suture of epistoma impressed. Dorsal and ven-

tral locomotory ampullae on abdominal segments I to VII shagreen, with minute granules.

Pupa: Body elongate, acicular spines on dorsal surface of first six abdominal tergites form one transversely elongate paramedial tuft on each. Tip of abdomen dorsally without urogomphi. Valvifers of female large, cylindrical, somewhat produced apically. This genus is monotypic.

Type species: *Leptura quadrivittata* Gebler, 1830.

KEY TO SUBSPECIES

Adult Insects

- 1 (2). Second to 4th antennal segments short; 4th segment considerably shorter than 5th, sometimes even shorter than 3rd. 1. **C. quadrivittata** (Gebler).
- 2 (1). Fourth antennal segment long, considerably longer than 2nd and 3rd segments together, equal to or somewhat longer than 5th. 2. **C. q. semenovi** Plav.

1. *Cornumutilla quadrivittata* (Gebler.)

Gebler, 1830, *Ledebour Reise*, 11, 2, 193 (*Leptura*); *semenovi*, Plavilstshikov [Plavil'shchikov], 1936, *Fauna SSSR*, 21, 1, 311-315; Gressit, 1951, *Longicorn Beetles of China*, vol. 2, p. 80 (*Cornumutilla semenovi* Plav.).

Adult (Figure 146): Body elongate. Head short, markedly bulges tubercularly at antennal bases; with minute uneven punctation, light-colored yellowish hairs, smooth narrow median longitudinal suture, sharp cervix posteriorly, and distinctly projecting glabrous temples. Genae small, as long as temples. Inner side of eyes with broad shallow emargination. Antennae with 11 segments, extend beyond middle of elytra (female); or with 12 segments and extend somewhat beyond elytral apex (male). Antennae matte from 4th segment upward. Third and fourth antennal segments short, considerably shorter than 5th (f. *typica*), but 4th segment often long, and it alone perceptibly longer than 5th (ssp. *semenovi* Plav.).

Pronotum bulges, not longer or only slightly longer than width at base, with sharp flange on anterior margin, latter markedly bent under, transverse narrow groove basally, and very or slightly broadly rounded laterally; with dense shallow punctation, light-colored, usually erect hairs, and more or less distinct, usually smooth median longitudinal groove. Scutellum elongate, narrowly rounded posteriorly; with sparse punctation and tender adherent hairs.

Elytra elongate, bulge moderately, with rounded, slightly projecting humeri, narrow more (male) or less (female) toward apex, individually rounded apically, with comparatively dense punctation and light-colored semiadherent hairs. Legs not very long; apices of hind femora do not reach hind clivus of elytra. Body ventrally with sparse gray hairs. Body black. Legs yellowish-red, femora and apices of tibiae rarely black. Antennae dark rust or dark brown, sometimes with very light-colored ringlets at bases of segments. Elytra with white longitudinal bands; two on disk extend from base to hind clivus, one each laterally. Sometimes
250 bands very well developed and fuse posteriorly, but sometimes reduced and lateral bands disappear. Rarely, elytra rusty with translucent

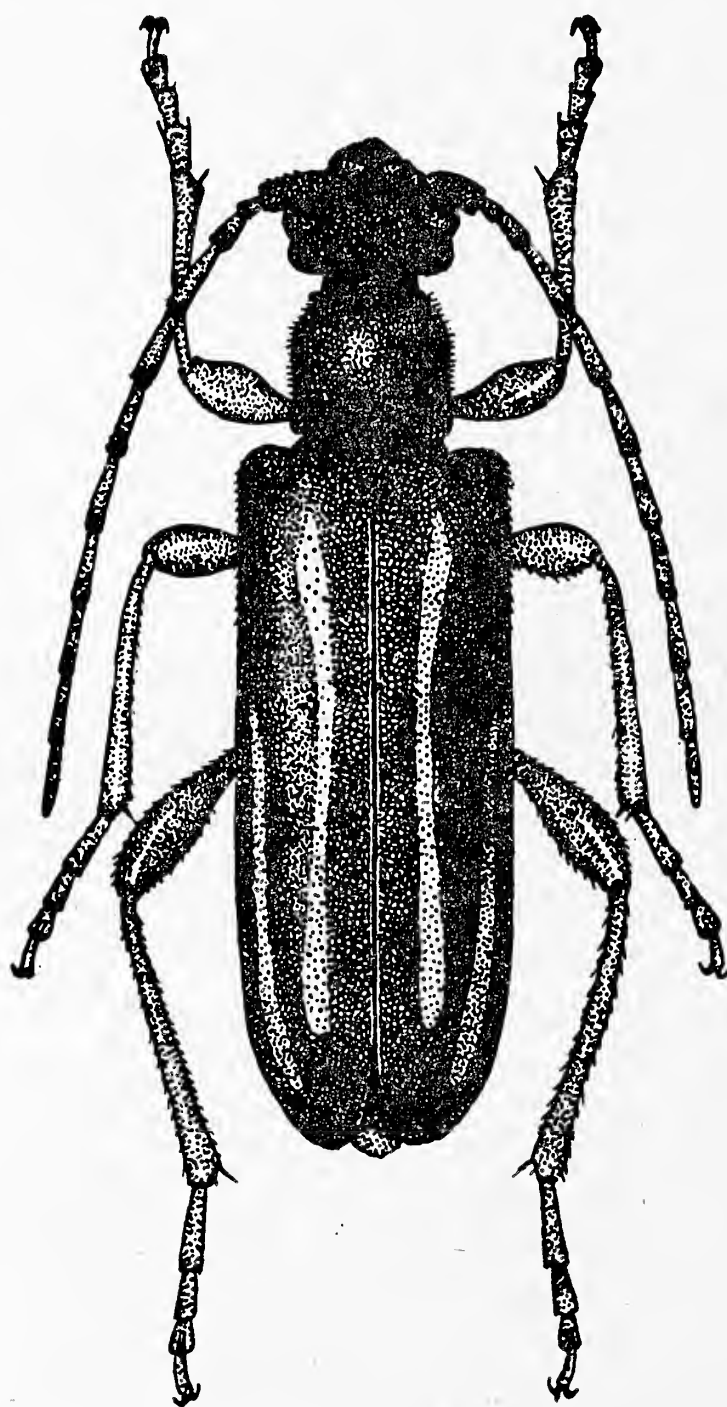


Figure 146. *Cornumutilla quadrivittata* (Gebler).

whitish longitudinal bands. Body length of male and female 8.0 to 12.0 mm.

Egg: White, acquiring in time brownish-cinnamon coloration, broadly rounded at one pole and usually narrowly rounded at the other. Chorion with dense cellular sculpture, distinct in live and dried eggs. Cells five- or six-faceted, with very narrow spaces between them, and bottom of cells shagreen. Length 1.8 to 2.0 mm, width 0.5 mm.

Larva (Figure 147): Body elongate but not flat. Head slightly retracted into prothorax, somewhat broadly rounded laterally, slightly wider than long. Epistoma narrowly triangular, bulges slightly beyond middle; with two setae forming transverse row together with pleural setae, with numerous piliform setae in anterior half, dark brown glabrous border on anterior margin, longitudinal suture impressed medially, narrow and brownish posteriorly, broader and lighter in color in front of dark border. Frontal sutures sharply defined, white. Parietals on head with very dense short and long hairs in front, with transparent, slightly elongate ocellus at base of antennae. Hypostoma trapezoidal, 2.0 to 2.5 times wider than long, bulges notably; with seven to eight setae on each side, straight sutures laterally, and white longitudinal gula medially. Clypeus broad, smooth, rusty at base. Labrum transversely elongate, truncate or widely but insignificantly emarginate on anterior margin, with long setae, brownish-rust at base. Mandibles massive, elongate, obliquely notched apically, with ventral and dorsal denticles, smooth on outer side, with transverse, sometimes indistinct medial dent.

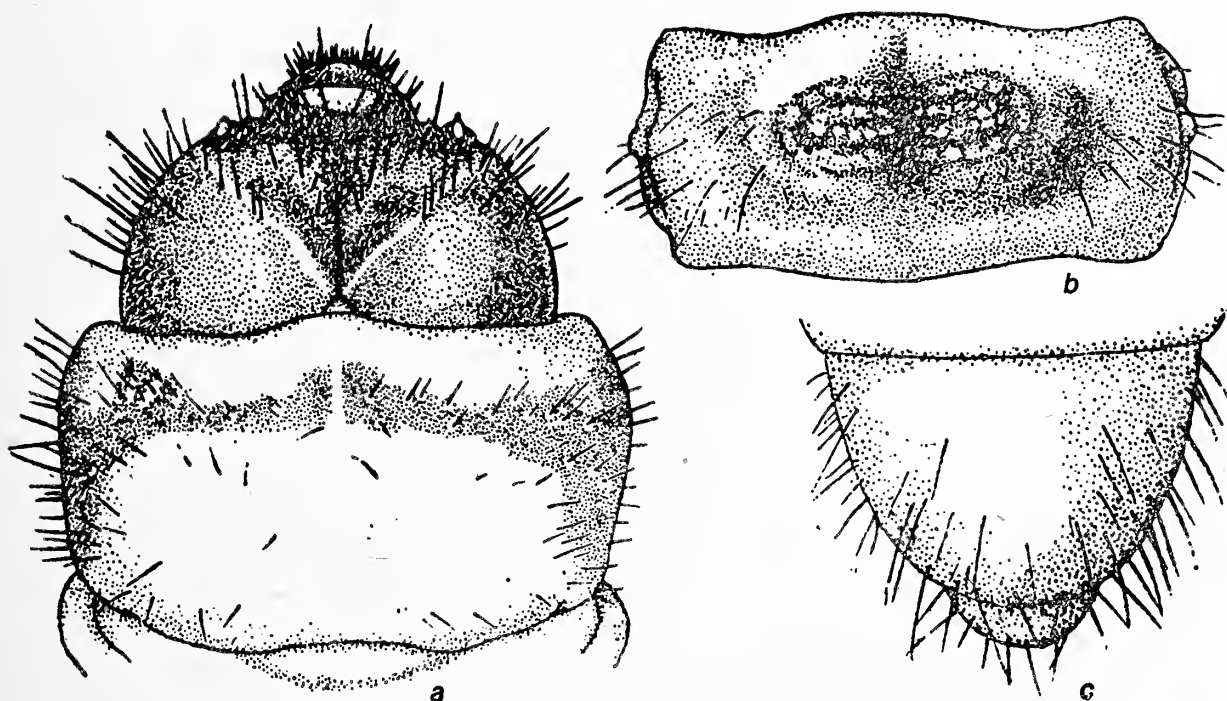


Figure 147. Larva of *Cornumutilla quadrivittata* (Gehl.).

a—head and pronotum; b—abdominal tergite with locomotory ampulla; c—tip of abdomen.

Pronotum moderately convex, slopes slightly forward, length almost 0.50 width; with sparse long thin setaceous hairs laterally and short ones on disk. Pronotal shield slightly convex, without lateral longitudinal folds, white, with stray short setaceous hairs. Prothoracic presternum with short hairs. Eusternum convex, with glabrous hairs in
 251 anterior half, glabrous at base. Meso- and metanota glabrous, shagreen. Thoracic legs well developed, thin, with sharp brownish claws.

Abdomen elongate, with sparse tender hairs laterally. Dorsal locomotory ampullae on abdominal tergites I to VII shagreen, divided by two transverse grooves that fuse laterally, with minute lustrous granules. Ventral locomotory ampullae on abdominal sternites I to VII shagreen, divided by transverse groove, with two rows of granules. Abdominal tergite IX with rounded posterior margin devoid of spinule, with stray long hairs in posterior half. Body white. Head yellowish, sometimes with rusty tinge; anterior margin of hypostoma dark brown; mandibles dark red. Pronotum with broad yellow transverse band anterior to middle; band with irregular anterior margin and laterally joins broad yellow zone. Body length 19 to 20 mm, width of head 2.8 mm.

Pupa (Figure 148): Body elongate. Head short, insignificantly bent under, not elongate anterior to eyes; six spinules at base of clypeus, group of setaceous spinules forming two transverse bands on inner side of antennal bases, transverse dent behind antennal bases, and two tubercular prominences behind dent with two lateral setae set on produced base on each side. Antennae curved, arcuate.

Pronotum bulges, gently rounded laterally, transverse, with perceptible flange on anterior margin, transversely and finely rugose on disk (as though with fine faint dashes); acicular spinules on anterior margin form transverse band, long large (female) or small (male) spinules at base form two tufts transversely spread out and significantly separated from each other, with faint stray spinules on disk and sides. Meso- and metanota with short sparse acicular spinules (female) or almost without them (male).

Abdomen elongate, almost does not broaden in middle, gradually but insignificantly narrows posteriorly. Abdominal tergites convex, with median longitudinal groove, with dense minute spinules in posterior
 252 half forming one transversely elongate paramedial tuft on each tergite. Tergites VII and VIII in posterior half with very dense large (female) or sparse small (male) spinules. Tip of abdomen obtuse (ventral view), bound by horseshoe-shaped carina, with acicular (setaceous) spinules. Valvifers of female very large, cylindrical, produced apically (dorsal view). Body length of male and female 12 to 15 mm.

Material: Altai (Lake Telets, Kolyushtu), Tuva. Beetles raised in the laboratory 25, pupae—three males and two females, larvae 74.

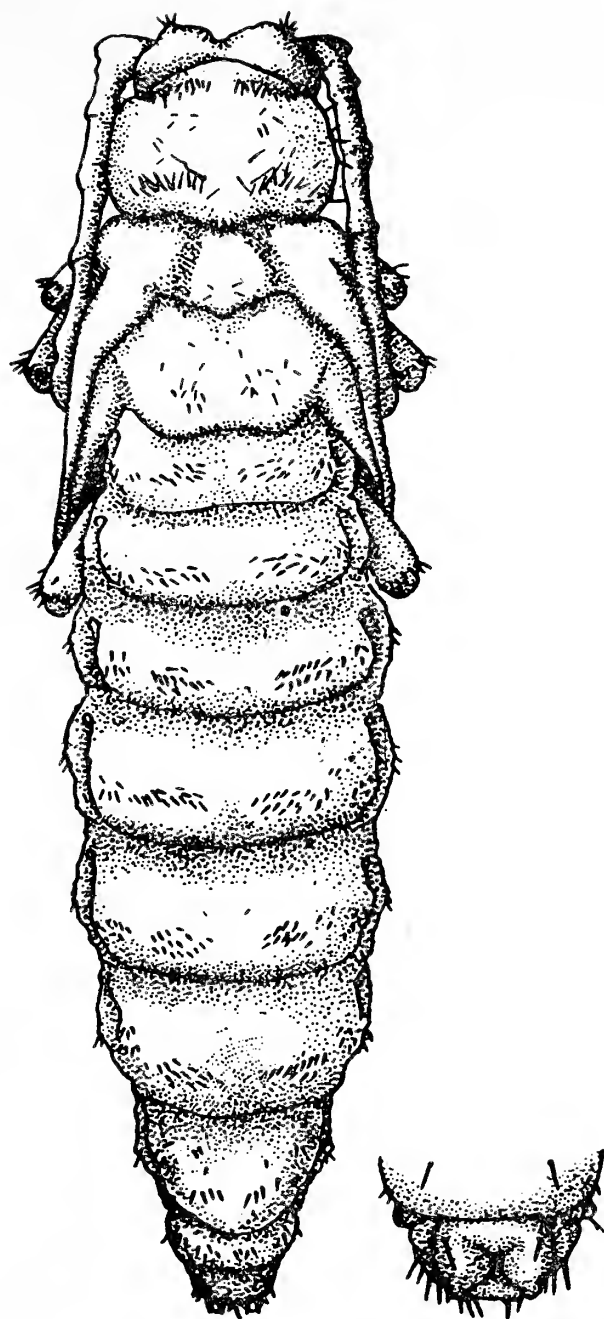


Figure 148. Pupa of *Cornumutilla quadrivittata* (Gehl.), female.

Distribution: Covers high-altitude and northern regions of coniferous forests from European Alps to Pacific Ocean coast. Found in northern Asia south from Altai and the Sayans north to the forest tundra.

Biology: Ecologically associated with coniferous forests. Inhabits taiga zone and mountain forest belt, extending in mountains to a height of 2,500 m above sea level, i.e., up to boundary of coniferous species, including mountain pine. Flight of beetles commences in first 10 days of July and ends in August. Beetles do not require supplementary feeding and usually not seen on flowers. After emerging from wood they mate immediately and oviposit. Ovaries of one female just emerged from wood contained 126 eggs. Female lays eggs in wood crevices of trunks of dead standing and fallen trees. Mainly trunks with exposed roots 7.0 to 50.0 cm or more in diameter colonized. Usually colonizes

Siberian stone pine (*Pinus sibirica*), Siberian spruce (*Picea obovata*), Siberian larch (*Larix sibirica*) and Siberian fir (*Abies sibirica*).

Larvae hatched in 18 to 20 (average 19.3) days from eggs laid in August in a forest canopy, with a morning temperature of 5.2 to 16.0°C, day temperature 13.2 to 27.4°C, and evening temperature 12.4 to 21.0°C. Hatching of larvae commences mid-August and ends in September. Larvae live for about three years in wood at a depth of up to 5.0 cm, make longitudinal galleries, and plug them with frass. Length of gallery over 20 cm, width up to 11 mm. Before pupation larva makes gallery horizontal to trunk surface, nibbles pupal cell across trunk, and pupates with head toward surface. Length of cell 15 to 20 mm, width 4.0 to 5.0 mm. Layer of wood 3.0 to 6.0 mm thick left between pupal cell and trunk surface.

Pupation of larvae observed after third hibernation in June. Sometimes larvae enter diapause before pupation, hibernate, and pupate the following spring. Duration of pupal stage about four weeks. Newly formed beetles nibble round openings up to 4.0 to 5.0 mm in trunk surface and exit. Weight of larvae ready for pupation 52 to 161 mg, pupae 56 to 94 mg or more, and beetles just emerging from wood 26.5 to 64.5 mg or more. Female weighs much more than male. Males raised by me in Altai weighed 26.5 to 37.0 mg and females 52.0 to 64.5 mg. Some larvae not ready for pupation weighed 189.5 to 235.0 mg. During preparation for pupation larvae lose 20 to 35% of their weight. This species is found sporadically. It usually colonizes small sections of tree trunks where up to seven insects may be found during the period of emergence of young beetles from wood. In high-altitude regions *Anoplodera rufiventris* (Geb.) sometimes colonizes the selfsame maple trees together with this species. Both species inhabit the basal zone of trunks of dead fallen trees and even the root mass.

2. *Cornumutilla quadrivittata semenovi* Plav.

Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 313-315.

Adult: Differs from the type form [*Cornumutilla quadrivittata* (Geb.)] in the following features: antennae comparatively thick, longer than body in male but considerably shorter in female. Fourth antennal segment longer than 2nd and 3rd together, slightly shorter or even not shorter than 5th.

Larva and *pupa* of this subspecies morphologically indistinguishable from the nominal form.

Taxonomic remarks: *Cornumutilla quadrivittata semenovi* Plav. was isolated as an independent species based on the unusual length of the 4th antennal segment, which is only slightly shorter than the 5th. However, an examination and comparison of collections with the type speci-

mens revealed that this feature is highly variable. For example, in a series of beetles taken from a single population in Altai, specimens were found in which the 4th antennal segment was either considerably shorter than the 5th, equal to it, or even markedly longer. Such specimens are biologically compatible, mate freely, and reproduce. Hence *Cornumutula quadrivittata semenovi* Plav. may only be regarded as a subspecies of *Cornumutula quadrivittata* (Geb.). This subspecies is mainly distributed from Altai to Yakutia and on Shantar Islands in the Sea of Okhotsk. Its biology is identical to that of *Cornumutula quadrivittata* (Geb.).

5. Genus *Nivellia* Muls.

Mulsant, 1863, *Coleopt. France, Longicorn*, 2nd ed., p. 564; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 315-316.

Adult: Body elongate. Antennae of male longer, of female considerably shorter than body. Pronotum with broad flange on anterior margin and narrow transverse groove basally. Elytra matte, slightly convex, with parallel sides (female) or narrow somewhat toward apex (male), individually rounded apically (somewhat obtuse), and taper more in region of outer angles.

Egg: Cellular sculpture sharp, distinct.

Larva: Head slightly retracted into prothorax, hypostoma only 2.0 times wider than long. Thoracic legs slender, not very long. Dorsal locomotory ampullae on abdominal tergites I to VII with granules forming nonconvergent semiellipsoidal transverse rows separated by median longitudinal groove. Differs from larvae of the genus *Cornumutula* in narrow longitudinal suture of epistoma does not broaden anteriorly, and marked sclerotization of eusternum.

Pupa: Body elongate. Anterior margin of pronotum with flange, abdominal tergites with short spinules that are quite diffuse [*N. sanguinosa* (Gyllh.)] or form transversely elongate paramedial tuft [*N. extensa* (Geb.)]. Tip of abdomen rounded, without urogomphi.

The genus *Nivellia* is represented by two species in USSR fauna. Of these, one [*Nivellia sanguinosa* (Gyllh.)] is widely distributed in the Palearctic region, and the other [*Nivellia extensa* (Geb.)] from Altai to Primor'e in Siberia, and is quite common in Japan. The latter species may be considered much younger, of post-Tertiary origin. It is associated with fauna formed during the evolution of coniferous forests.

Type species: *Leptura sanguinosa* Gyllenhal, 1827.

KEY TO SPECIES

Adult Insects

- 1 (2). Elytra red, pronotum glabrous. Parameres of male genitalia with apical tuft of long setae, almost 5.0 times longer than lateral setae. 1. *N. sanguinosa* (Gyllh.).
- 2 (1). Elytra black, pronotum with adherent hairs. Parameres of male genitalia with apical tuft of short setae, not longer than lateral setae. 2. *N. extensa* (Gehl.).

Larvae

- 1 (2). Labial submentum with three setae; hypostoma without longitudinal dents. Found on deciduous wood species. 1. *N. sanguinosa* (Gyllh.).
- 2 (1). Labial submentum with two setae; hypostoma with median longitudinal dent. Found on fir. 2. *N. extensa* (Gehl.).

Pupae

- 1 (2). Spinules on abdominal tergites minute, diffuse, do not form distinct tufts. 1. *N. sanguinosa* (Gyllh.).
- 2 (1). Spinules on abdominal tergites very large, not diffuse, form dense transversely elongate tuft on each side of longitudinal groove. 2. *N. extensa* (Gehl.).

1. *Nivellia sanguinosa* (Gyllh.)

Gyllenhal, 1827, *Insec. Suec.*, 1, 4, 21 (*Leptura*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 316-317; Kojima and Hayashi, 1969, *Insect Life in Japan*, vol. 1, p. 25; Cherepanov and Cherepanova, 1975, *Zhukidrovoseki ivovkh lesov Sibiri*, pp. 53-57.

Adult (Figure 149): Readily distinguished by body shape and color of elytra. Body elongate, slightly convex, almost flat. Head constricted behind temples, with dense coarse punctation; temples short and rounded; frons with smooth median longitudinal band. Eyes bulge, large, with minute sharp facets, not deeply emarginate. Antennae barely extend beyond apex of elytra (male) or considerably shorter (female).

Pronotum bulges, glabrous, without hair cover; with continuous dense punctation (spaces between punctures in form of minute septa), narrows anteriorly, somewhat elongate in male, not longer than width at base in female, with notable flange on anterior margin and faint transverse groove basally. Scutellum elongate, triangular, narrowly rounded apically, with fine punctation.

Elytra parallel, bulge slightly on disk, with two barely perceptible
255 longitudinal ridges (under high magnification), matte, with uniform
punctation, and semiadherent hairs; outer side of apex gently rounded,
inner angles obtuse. Legs moderately long; hind tibiae curve markedly
in male, straight in female. Parameres of male genitalia narrowly round-
ed apically and with long setae here; these setae almost 5.0 times longer

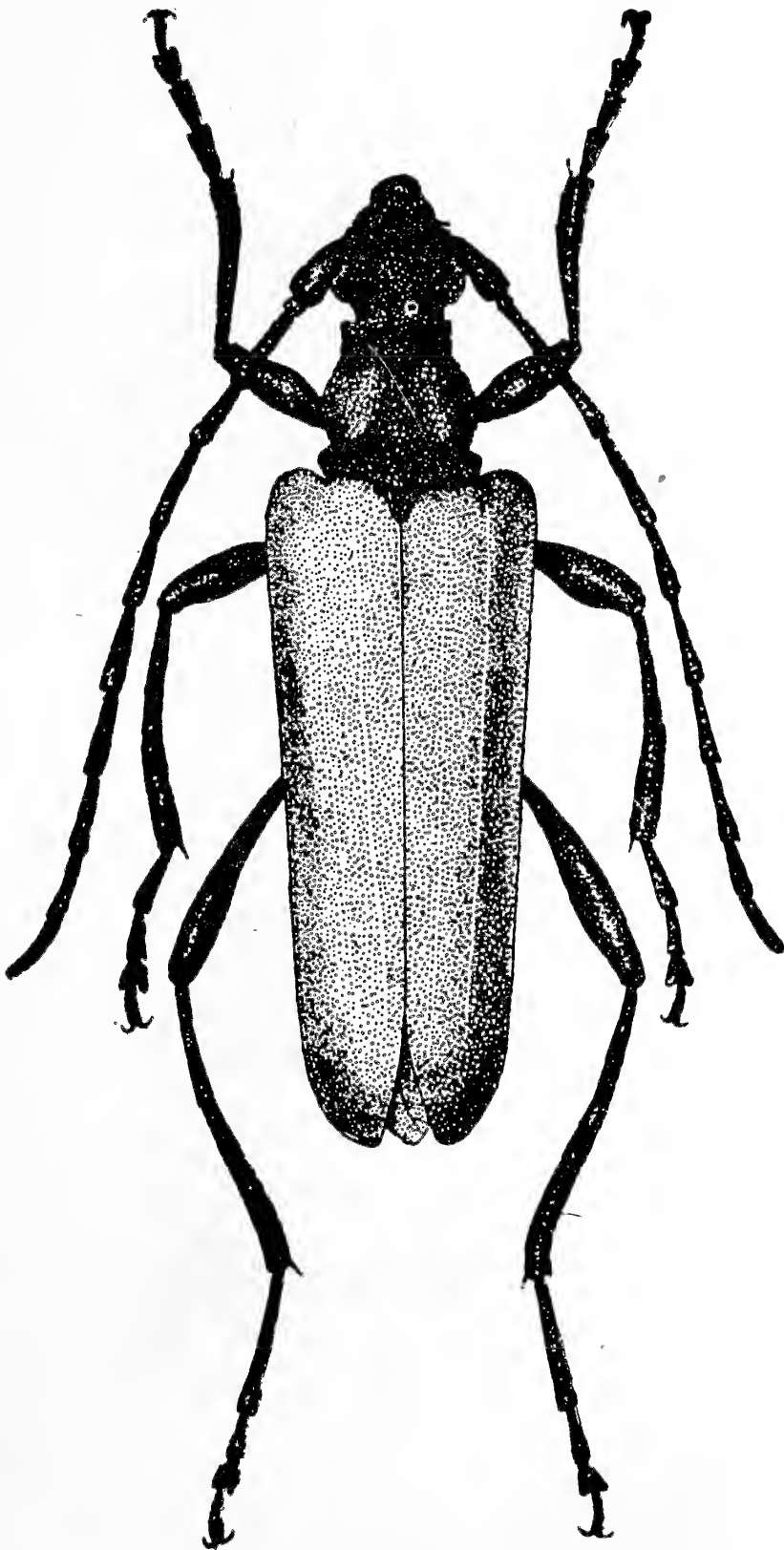


Figure 149. *Nivellita sanguinosa* (Gyllh.).

than lateral setae and form small brushlike tufts. Body black, antennae apically brownish, elytra red. Length of body 10 to 14 mm.

Egg: Elongate, narrows more toward one pole, narrowly rounded at both poles, whitish-yellow. Chorion matte, with dense minute five- to six-faceted deep cells; spaces between cells narrow, septate. Length 1.8 mm, width 0.8 mm.

Larva (Figure 150): Differs from larvae of other species in structure of epistoma and dorsal locomotory ampullae. Body elongate, with parallel sides, narrows only terminally. Head bent downward, laterally rounded, somewhat wider than long. Epistoma triangular, bound by

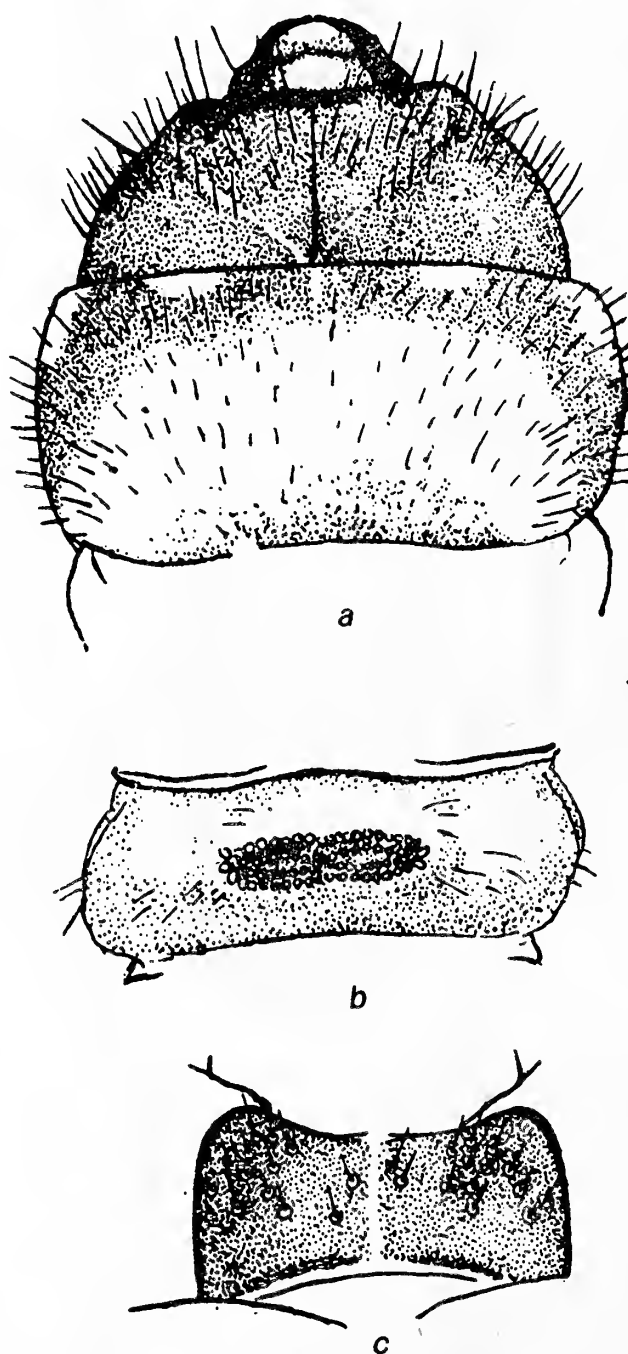


Figure 150. Larva of *Nivellia sanguinosa* (Gyllh.).
a—head and pronotum; b—abdominal tergite with locomotory ampulla; c—hypostoma.

distinct whitish frontal sutures, medially divided by brownish longitudinal suture (sutura medialis) almost throughout length, notably bulges tubercularly on anterior margin along sides of longitudinal suture; with broad light-colored diffuse transverse band in anterior half, and short setaceous hairs. Hypostoma entire, trapezoidal, distinctly narrows anteriorly, medially with narrow longitudinal white band, with five to twelve diffuse setaceous paramedial pores. Parietals on head with short setaceous hairs in anterior half, and three contiguous hyaline ocelli at antennal base. Clypeus transverse, smooth, and white. Labrum transversely oval, with short setae on anterior margin. Mandibles comparatively short, obliquely notched apically.

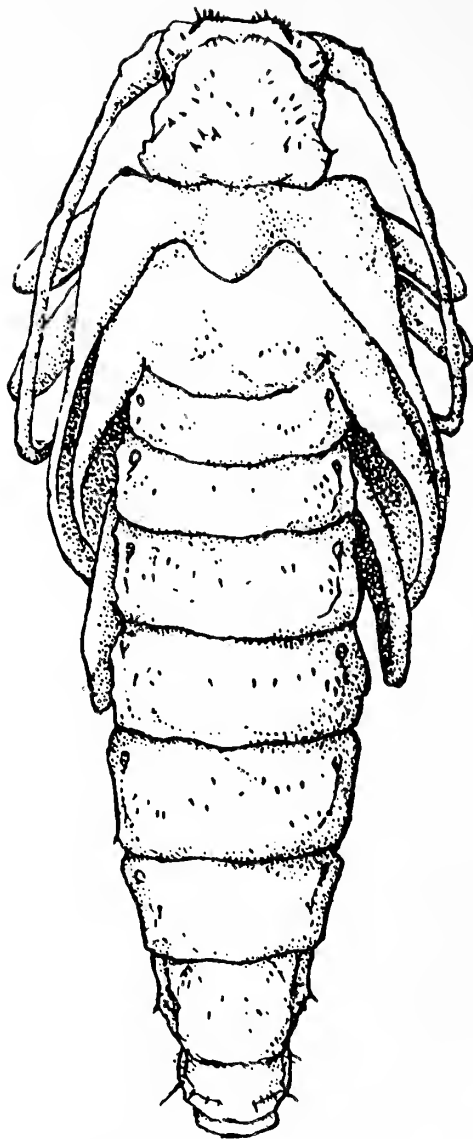
Pronotum slopes moderately anteriorly, medially glabrous on anterior margin; with stray short setae laterally and elongate sparse hairs 256 mediolaterally. Pronotal shield whitish, insignificantly raised, bound basally by short, barely perceptible lateral folds. Sclerites of meso- and metathorax (meso- and metasterna) shagreen, with very small spinules (visible only under high magnification). Prosternum in anterior half with minute uniform setaceous hairs; eusternum convex, medially or mostly sclerotized; with very small spinules usually forming broad transverse band. Legs developed but short, with pointed insignificantly curved claws.

Abdominal segments broaden angularly. Dorsal locomotory ampullae divided by broad median longitudinal groove; with minute round granules forming transverse row that arcs laterally but does not close medially into single ring; shagreen medially in region of transverse carina and in posterior half. Ventral locomotory ampullae shagreen, with straight or obliquely elongate granules forming two transverse rows. Body white, head rusty, darkens along anterior margin. Mandibles black. Sides and anterior half of pronotum rusty with yellow tinge. Length of body before pupation 18 to 23 mm, width of head 2.5 mm.

Pupa (Figure 151): Body elongate, head bent under. Frons flat in 257 male, longitudinally impressed troughlike between antennae in female, with short setae on anterior margin and at antennal bases laterally. Antennae bend around midfemora.

Pronotum narrows anteriorly, slightly convex on disk, on anterior margin with group of raised setae medially, and diffuse spinescent setae forming two paramedial tufts basally. Sometimes latter setae more or less diffuse.

Abdomen elongate in male, broader in female in segments III to V, and narrows apically. Abdominal tergites broad, bulge slightly, in posterior half with short acute, uniformly spaced or grouped spinules directed backward and sometimes forming transverse row. Abdominal tergite IX in male rounded posteriorly, with acute acicular spinules; more or less obtuse in female, with pair of acicular spinules laterally and

Figure 151. Pupa of *Nivellia sanguinosa* (Gyllh.).

sometimes medially with two wartlike projections. Valvifers of female large, conical, with apices directed sideways. Length 12 to 15 mm. Width of abdomen 3.0 to 4.0 mm. Sometimes spinules on abdominal tergites poorly developed in pupae, almost imperceptible, but contrarily, very large on tip of abdomen and set on papilliform base.

Material: Ussuri-Primor'e region—raised in laboratory: beetles 12, pupae four (two males, two females), larvae 36 in 1972; Altai, Lake Telets—beetles, 22, pupae five (three females, two males), larvae 45 in 1969 and 1975. Over 200 beetles collected in nature.

Distribution: Eurasia, from Atlantic to Pacific Ocean coasts. In Siberia from state boundaries south to forest zone north. Places of recovery: Tyumen', Omsk, Barnaul, Lake Telets, Novosibirsk, Tomsk, Kemerovo, Salair, Abakan, western Sayans, Tuva, Krasnoyarsk, Yakutia, Irkutsk, Chita, Magadan, Vladivostok, Sakhalin, and Kunashir.

Biology: This red-winged species inhabits deciduous and mixed forests. Found in low- and high-altitude forests, rising in mountains to 1,200

m above sea level. Sporadically numerous. Flight of beetles prolonged, commencing end of May and continuing almost up to mid-August. Beetles maximum in last 10 days of June and first half of July. For example, in Altai of 270 beetles collected in one season, 0.7% were found end of May, 11.2%—first 20 days of June, 28.9%—last 10 days of June, 50.7%—first 10 days of July and 8.5%—later in the season. High in the mountains (1,000 to 2,000 m) flight commences in second half of June and ceases by end of July. Beetles often feed on pollen of flowers. More active in clear warm weather. After mating female lays eggs under bark of dead standing or fallen trees. Colonizes branches and trunks of willow (*Salix*), bird-cherry (*Padus*), alder (*Alnus*), hazel nut (*Corylus*), maple (*Acer*), honeysuckle (*Carpinus*), rhododendron (*Rhododendron*), mountain ash (*Sorbus*), and other deciduous species. One female can lay up to 35 eggs. Developmental period of eggs from moment of oviposition to hatching of larvae 19 to 22 days.

Hatching of larvae commences end of June or in July and is completed end of August or early September. Larvae initially live under bark, then bore into wood, make longitudinal galleries there, and plug them with dense frass. Length of gallery in wood up to 23 cm, width up to 7.0 mm. Before pupation larva makes falcate exit in bark, its size on wood surface 4.0 mm \times 5.0 mm, then moves backward to plug it with frass, and pupates in resultant cell. Pupa lies with head toward exit. Length of cell 20 to 28 mm, width 5.0 to 8.0 mm. Length of gallery from exit to pupal cell 5.0 to 5.3 mm. Length of frass plug sealing exit of pupal cell 4.0 mm. Duration of pupal stage not less than two weeks. Pupae found from May through July. Young beetles seen from end of May or early June; they remain in cell for five to seven days, then break the sealing plug, push aside frass, nibble a round opening (4.0 to 5.0 mm in diameter) in bark, and exit. Emergence of beetles from wood ceases in June. Gonads of emergent beetles fully developed but they nonetheless resort to supplementary feeding on flowers.

Weight of larvae before pupation 56.4 to 148.0 mg, pupae 50.0 to 134.8 mg, and beetles before emerging from wood 45 to 121 mg. Life cycle completed in two years (Table 9).

The population density of this red-winged species is illustrated by the following data: eight insects including three larvae under bark, two prepupae in wood, two pupae and one adult recovered from a hazel nut shoot 18.5 cm long and 3.5 cm in diameter. Four insects (two pupae and two adults) were found in a hazel nut shoot 28 cm long and 3.0 cm in diameter. Five larvae and one pupa were found in a shoot of mountain ash 20 cm long and 4.0 cm in diameter.

Table 9. Development of *Nivellia sanguinosa* (Gyllh.)

Year of develop- ment	April	May	June	July	August	Septem- ber	Octo- ber
1st	L	LPA	LPAE	PAE	AEL	EL	L
2nd	L	L	L	L	L	L	L
3rd	L	LPA	LPAE	PAE	AEL	EL	L

2. *Nivellia extensa* (Gebler)

Gebler, 1841, *Bull. Soc. Nat. Moscou*, vol. 14, p. 613 (*Leptura*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 317 (ab. *extensa* Gebler); Kojima and Hayashi, 1969, *Insect Life in Japan*, vol. 1, 25; Cherepanov and Cherepanova, 1977, *Taksony fauny Sibiri (Nov. i maloizv. vidy fauny Sibiri)*, pp. 47-53.

Adult (Figure 152): Readily distinguished from *Nivellia sanguinosa* (Gyllh.) by black elytra and pubescent pronotum. Body elongate, broader in female than in male. Head directed forward, slightly inclined ventrally, with dense deep punctation. Frontal tubercles between antennae highly convex, gently rounded, appear to diverge posteriorly, and divided by deep longitudinal suture. Antennae long; 11th segment in male reaches or extends beyond elytral apex, but much shorter in female; with dense minute light-colored hairs.

Pronotum elongate, in any case not wider than long, with broad median longitudinal groove, convex on disk along sides, markedly narrows anteriorly, with broad flange in anterior third, sharp transverse groove at base, with dense large, and almost uniform punctation; in male long tender yellowish hairs combed prominently from sides and midline toward anterior margin, in female hairs short and sparse. Legs comparatively slender; femora thicken slightly toward apex; hind tarsi, especially in female, shorter than tibiae, and 1st segment considerably longer than other segments together.

Elytra matte, parallel in female, narrow slightly toward apex in male, slightly obtuse apically, with rounded, slightly convex, almost flat angles; with dense minute notched punctation and minute, barely perceptible hairs. Parameres of male genitalia with short apical setae
 259 not longer than lateral ones, forming loose, not brush-like tufts. Body, antennae, legs, and elytra black. Length of body 13 to 17 mm.

Egg: White, with time turns pinkish; elongate, obtuse at one end, narrowly rounded at the other, with distinct flat, almost hexagonal cells (cells in *Nivellia sanguinosa* deeper). Cell bottom flat, silvery, very minutely speckled (visible under high magnification). Spaces between

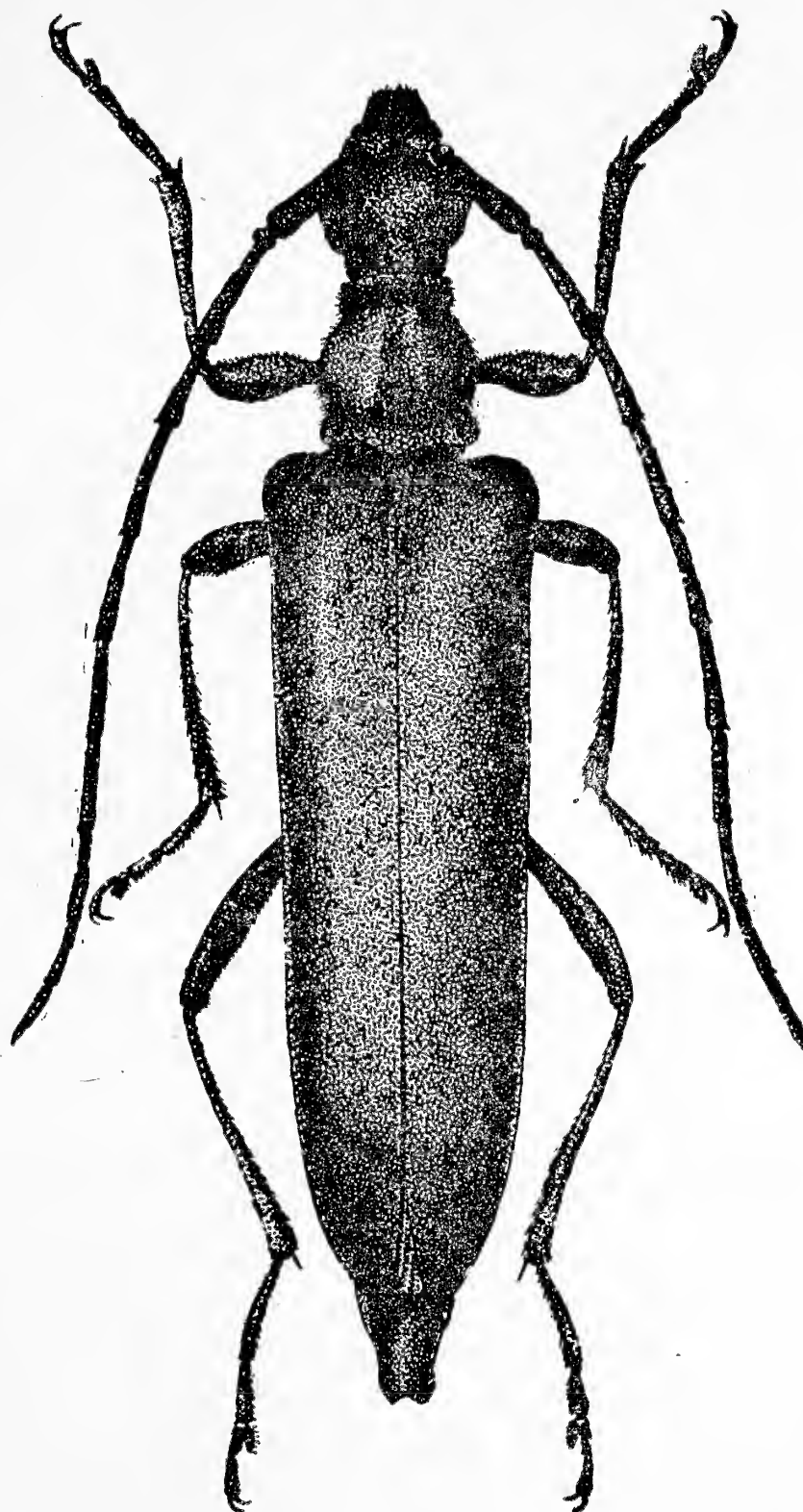
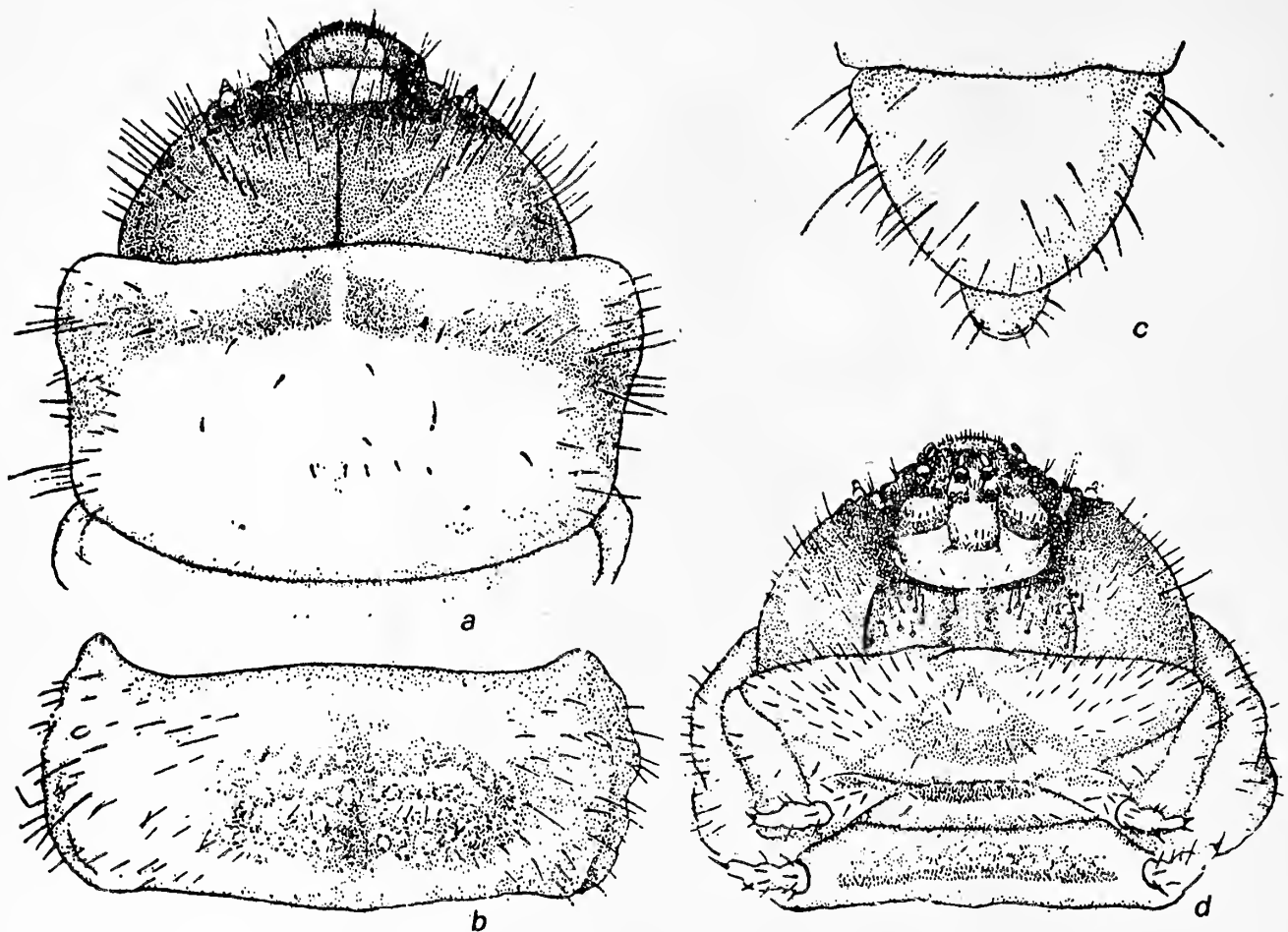


Figure 152. *Nivellia extensa* (Geb.), female.

cells narrow, somewhat narrower than cells themselves. Length 2.0 mm, width 0.6 mm.

Larva (Figure 153): Very similar to larva of *Nivellia sanguinosa* (Gyllh.). Differs in presence of two setae on labial submentum and smaller number of setaceous pores on hypostoma. Body elongate, pointed apically. Head narrowly rounded anteriorly, with long setaceous rusty hairs in anterior half (on sides and in epistomal region). Epistoma triangular, bound laterally by distinct white frontal sutures, divided by



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Figure 153. Larva of *Nivellia extensa* (Geb.). a—head and pronotum; b—abdominal tergite with locomotory ampulla; c—tip of abdomen; d—head, pro-, and mesothorax (ventral view).

brownish median longitudinal suture, markedly impressed along suture in posterior half, and paramedially tubercular along anterior margin. Hypostoma narrows somewhat anteriorly, slightly convex, with white median longitudinal band, and barely perceptible broad longitudinal paramedial dents; with dense setaceous pores, of which two proximate to white longitudinal band and remainder lateral to longitudinal dents (usually seven to nine setaceous pores on each side). Parietals on head convex, in anterior half dorsally with long, laterally and ventrally with short setaceous hairs. Ocelli (three) not pigmented and form distinct transverse band behind antennae. Clypeus trapezoidal, large, smooth, produced at anterior angles. Labrum transverse, with truncate anterior margin and long setae; lustrous and smooth on disk and base, without setae. Mandibles insignificantly elongate, obliquely truncate or slightly notched apically. Labial submentum with two setae in transverse row.

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Pronotum transverse, broad, flattened in anterior half of disk, with stray, sparsely dispersed, short setaceous hairs. Pronotal shield white, bulges, without perceptible lateral folds. Prosternum with comparatively dense short setaceous hairs. Eusternum convex, triangular, sclerotized

(with minute spinules), and coriaceous (without spinules) only at anterior and posterior margins. Disks of meso- and metanota with dense minute sclerotized spinules forming two compact yellow bands. Thoracic legs well developed, basally with rusty sclerotized ringlet, with acicular, slightly curved claws.

Abdomen elongate, with short rusty hairs laterally. Dorsal locomotory ampullae convex, divided by deep longitudinal groove; with fine lustrous granules forming four transverse rows interrupted medially by longitudinal groove and bordered, especially laterally and posteriorly by narrow yellowish sclerotized band consisting of minute dense spinules. Disk of tergite VIII glabrous, somewhat depressed, with sparse hairs laterally. Tergite IX markedly narrows posteriorly; with long setaceous hairs in posterior half forming two fairly distinct transverse rows. Body white; head rusty, dark brown along anterior margin; mandibles reddish-brown, nearly black. Pronotum in anterior half with transverse rusty band, white notches on anterior margin, and longitudinal white band in middle. Length of body before pupation 16 to 22 mm, width of head up to 3.0 mm.

Pupa (Figure 154): Readily distinguished from *Nivellia sanguinosa* (Gyllh.) by disposition of spinules on pronotum and abdominal tergites. Body elongate, narrows somewhat posteriorly. Head moderately bent under. Frons transversely striate, transversely bulges anterior to clypeus, with paired setae on prominences forming transverse row, longitudinal suture between antennae, and uneven setae lateral to antennal bases forming two indistinct longitudinal rows. Parietals convex behind antennae, with short acicular setae. Antennae flexed to sides, arcuate, bend ventrad in distal half.

Pronotum barely longer than wide, laterally produced, and transversely impressed in anterior half of disk; with transverse striation, acutely acicular minute spinules on anterior margin and anterior to middle, much larger spinules laterally at base disposed on conically produced tubercles. Metanotum transversely striate, gently impressed on disk, with minute acute spinules in posterior half near median longitudinal line forming transverse band.

Abdomen markedly elongate, slightly narrows posteriorly. Abdominal tergites convex, with faint broad median groove, acute paramedial spinules in posterior half set on protuberant base forming tufts in transverse band (nine to ten spinules on each side of groove); stray lateral spinules form transverse row. Tip of abdomen bound by obtusely rounded carina set with six acute spinules on each side. Valvifers of female large, spherical, with papilliform tubercles. Length 13 to 16 mm, width of abdomen 3.0 to 3.5 mm.

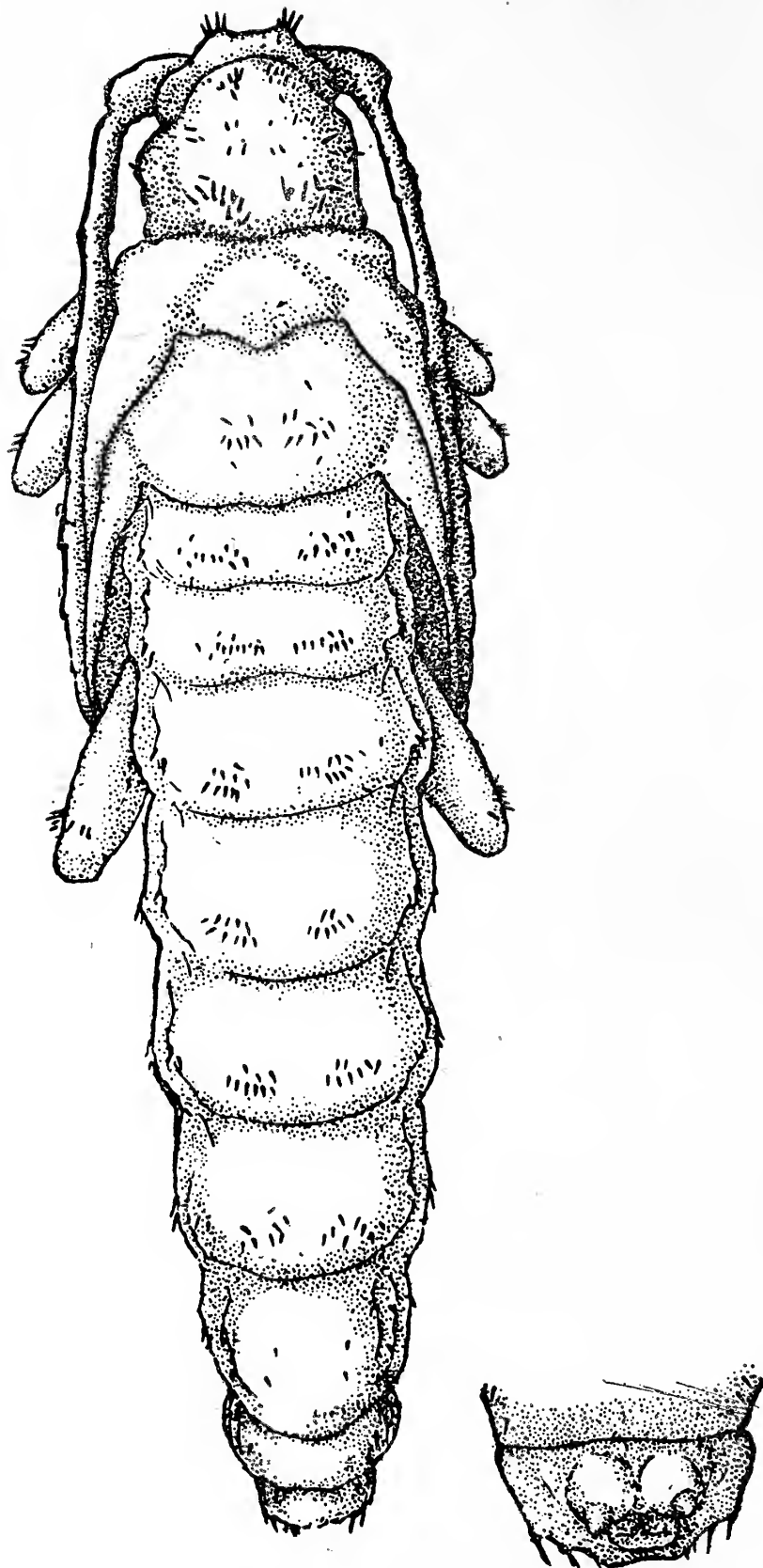


Figure 154. Pupa of *Nivellia extensa* (Gebler), female.

Taxonomic remarks: *Nivellia extensa* (Gebler) is well distinguished in the adult stage by structure of male genitalia and color of elytra [black, not red as in *N. sanguinosa* (Gyllh.), a characteristic that is very stable]; in the larval stage distinguished by very dense setaceous pores on hypostoma; and in the pupal stage by distinct tufts of spinules on abdominal tergites. It was also established that active mating of beetles in gardens

occurs only intraspecifically; males of *N. extensa* (Geb.) mated eagerly only with females of the same species and were not attracted to females *N. sanguinosa* (Gyllh.). Such behavior is an indication of the biological incompatibility of these species.

262 *Material*: Altai, Lake Telets. We raised 37 beetles, two pupae (one male, one female), and 36 larvae in the laboratory from June to November, 1975. An additional 35 beetles were collected in nature and examined.

Distribution: Siberia, from Altai to Pacific Ocean coast, Sakhalin; Japan. Places of detection: Altai (region of Lake Telets), Gornaya Shoriya, Tuva (Khundurgun Pass), and Primor'e (Kedrovaya valley sanctuary).

Biology: Inhabits coniferous forests. Reaches a height of 2,500 m in mountains. Flight observed from end of June to end of August. Beetles usually remain concealed, rarely seen on flowers. Eggs laid in bark crevices, mainly on fir. In gardens (in the laboratory pine, fir, and willow cuttings were available) female colonizes only fir but, in its absence, will lay a few eggs on pine cuttings. Willow was never inhabited. In nature larvae, pupae, and adult insects of this species are found on fir. Two beetles were raised from larvae extracted from a desiccated larch. Eggs usually laid on trunks of decaying undergrowth up to 10 cm in diameter on the underside at a height of not more than 2.0 m. Developmental period of eggs from oviposition to hatching of larvae at 18°C lasts for 16 to 20 days.

Hatching of larvae recorded in last 10 days of July and in August. Young larvae bore into bark, initially live under it, then penetrate deeper into wood and there make upward longitudinal galleries in upper layer, plugging them with frass. Mature larvae make hollow (not filled with frass) galleries and bore exit in upper end almost up to bark, leaving a layer of wood up to 2.0 mm in thickness. Sometimes larvae nibble an exit up to bark, in which case the blind end adjoining bark is plugged with fibrous frass. A pupal cell is made later in lower part of hollow gallery and sealed with plug of fibrous frass. Larva turns its head upward to pupate. Length of cell 25 mm, width 8.0 mm. Length of plug sealing cell from hollow gallery 10 to 12 mm. Length of hollow gallery 5.0 to 6.5 cm.

Larvae pupate after second overwintering in last few days of May and in June. Young beetles sighted in second half of June and in July. They remain in pupal cell for about one week, then loosen plug, push frass aside, move to exit, nibble an oval opening in bark, and abandon wood through it. Size of exit (flight opening) 3.0 mm × 4.0 mm. Emergence of young beetles from wood completed by end of June and in first half of July. Beetles maximum around July 20. They emerge from wood with developed gonads and are capable of reproducing with-

out supplementary feeding. They mate immediately on emerging from wood, and the female oviposits soon thereafter. One female can lay over 40 eggs. Two females just emerged from wood were dissected and 40 and 44 mature eggs found in the ovaries. Weight of larvae before pupation 44 to 120 mg, pupae 30.5 to 115.0 mg, and adults 30.5 to 105.5 mg. Population density usually not very high. On thin trunks of fir undergrowth ranging from 6.0 to 8.0 cm in diameter, two to four insects were found. *Clytus arietoides* Reitt. and *Rhagium inquisitor* (L.) usually colonize fir together with this species.

6. Genus *Strangalomorpha* Sols.

Solsky, 1873, *Hor. Soc. Entom. Ross.*, vol. 9, p. 253; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 317; Gressit, 1951, *Longicorn Beetles of China*, vol. 2, p. 104 (subgenus *Strangalomorpha*).

Adult: Differs from those of other genera of this tribe in very narrow elongate body, long slender legs, and uniformly dark-colored elytra, with some bronze or metallic sheen.

Egg: Characterized by sharp cellular sculpture.

Larva: Hypostoma densely covered with setae. Pronotum with yellow band, without saccate deep white notches laterally. Thoracic legs developed. Dorsal and ventral locomotory ampullae on abdominal segments I to VII with hyaline granules and very small sclerotized spinules between them imparting brown tone.

Pupa: Body slender. Abdomen markedly elongate, abdominal tergites with spinules forming transverse band or row. Tip of abdomen with small paired urogomphi dorsally. Hind femora long, flexed to sides, with species extending beyond abdominal tergite V.

The larvae of this genus approach those of *Nivellia* and *Cornumutilla* in structure of locomotory ampullae, but differ considerably from larvae of the genus *Leptura*. The pupae of the genus *Strangalomorpha* approach those of the genus *Leptura* in presence of paired urogomphi on tip of abdomen, but are entirely different from pupae of *Nivellia* and *Cornumutilla*.

The genus *Strangalomorpha* is apparently independent in origin. It is more restricted to the fauna of broad-leaved forests of southeast Asia.

Type species: *Strangalomorpha tenuis* Solsky, 1873.

1. *Strangalomorpha tenuis* Sols.

Solsky, 1873, *Hor. Soc. Entom. Ross.*, vol. 9, p. 253; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 318-319; Cherepanov and Cherepanova, *Zhuki-drovoseki ivovykh lesov Sibiri*, p. 61.

Adult (Figure 155): Body slender, more elongate in male. Head with dense minute punctation, sharply elongate behind eyes; temples round, comparatively short; frons with median longitudinal line. Eyes large and convex, with very small facets and small emarginations. Antennae thin; 9th segment in male extends beyond apex of elytra while 11th segment in female just reaches elytral apex.

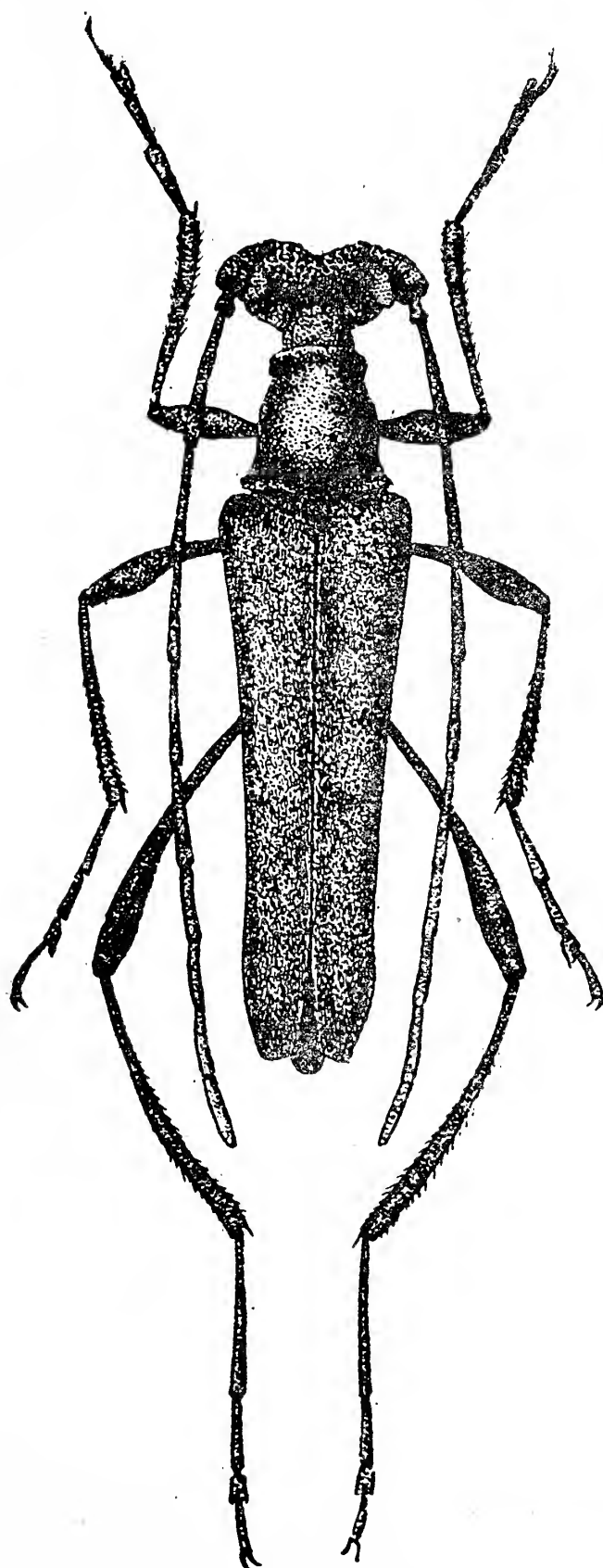


Figure 155. *Strangalomorpha tenuis* Sols.

Pronotum at anterior margin slightly more than 0.50 width at posterior margin, with dense minute punctation; disk narrows tubercularly in anterior half (male) or rounded gently (female) and raised; distinct flange before anterior margin and small transverse groove basally. Scutellum broadens basally, narrowly rounded apically, with dense punctation.

Elytra narrow, elongate, almost parallel in male, broadly notched in female, notably narrow toward apex, truncate apically, with faintly rounded outer angles; with moderately deep punctation, impressed longitudinally on disk at suture, with rim of suture raised. Legs very long and slender; apices of hind femora extend beyond 0.75 length of elytra. Body black, with brown tinge and minute shallow adherent hairs; antennae black, sometimes rusty apically. Length of body 8.0 to 15.0 mm.

Egg: Elongate, obtusely rounded at one pole, narrows abruptly at the other, with papilliform protuberance. Chorion with broad poly- or hexagonal sharp cells. Bottom of cells dark brown, space between them silvery-white. Length 1.9 mm, width 0.6 mm.

Larva (Figure 156): Body elongate. Head narrowly rounded anteriorly, transverse, insignificantly retracted into prothorax. Epistoma triangular, with distinct whitish frontal sutures laterally, sharp brown median longitudinal suture, and numerous setaceous hairs in anterior half. Hypostoma entire, bulges somewhat, medially with white longitudinal band, straight sutures laterally, narrows anteriorly, with acute sharp projecting anterior angles; large number of setae—six to eight anterior to middle form indistinct transverse row, three shifted to each

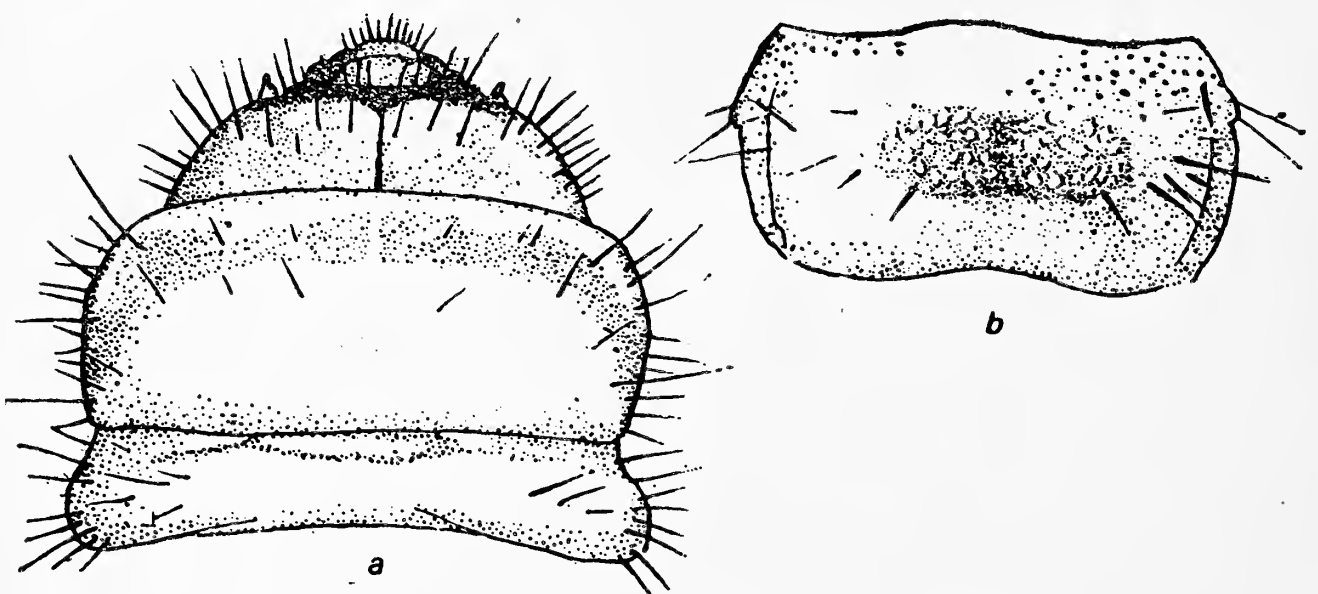


Figure 156. Larva of *Strangalomorpha tenuis* Sols.
a—head and pronotum; b—abdominal tergite with locomotory ampulla.

side form second transverse row broadly interrupted medially, sometimes with two or three additional setae shifted toward posterior angles. In some specimens number of setae reduced to five to six in anterior row and only stray ones remain in posterior rows. Anterior half of head laterally with long stray hairs. Clypeus broad and trapezoidal. Labrum narrows toward base, gently rounded at anterior margin, with sparse setae. Prosternum with sparse short hairs, sides (pleura) with minute setaceous brownish spinules imparting rough, almost setaceous appearance.

Pronotum slopes insignificantly, flat on disk, with long tender hairs laterally, glabrous or with stray short hairs on anterior margin. Pronotal shield white, bulges slightly, without lateral longitudinal folds; with stray short setaceous hairs on anterior margin and dense fine striation basally. Legs well developed, short, with acute, somewhat curved claws.

Abdomen gradually narrows posteriorly. Dorsal locomotory ampullae shagreen in middle, with minute paramedial granules forming two rows that curve inward. Ventral locomotory ampullae with two transverse rows of granules, bordered anteriorly and posteriorly by shagreen band. Body white. Head rusty, with black border on anterior margin. Mandibles black. Pronotum rusty laterally and on anterior margin, with yellow tinge, white longitudinal band medially, and two small white notches laterally on anterior margin. Length of mature larvae 14 to 18 mm, width of head 2.1 mm.

Pupa (Figure 157): Distinguished by long slender hind femora flexed to sides of abdomen and arrangement of setae on dorsal side of body. Body elongate. Head narrows markedly anterior to eyes. Anterior margin of frons in female with four and in male with two setae; base of antennae laterally with three to four setae. Antennae curve around mid-femora, annular.

Pronotum elongate, bulges on disk, markedly narrows anteriorly; 265 with dense setae forming transverse row on anterior margin, diffuse setae on disk, and group of setae forming two paramedial tufts basally. Apices of hind femora reach beyond abdominal tergite V.

Abdomen elongate, narrows posteriorly. Abdominal tergites convex, with thin setaceous spinules in posterior half in female forming diffuse row, tubercularly raised contiguous spinules on tergites I to VI in male forming one short paramedial sloping band; sometimes spinules in male do not differ from those in female. Tergites VII to VIII with long thin setae. Posterior margin of tergite IX rounded, with two urogomphi turned posterodorsal in female, anterodorsal in male, with long setae forming brushlike tuft on each side alongside lateral carinae. Valvifers of female large, contiguous, and apically produced into a papilliform process. Length of body 9.0 to 14.0 mm, width of abdomen 2.8 to 3.1 mm.

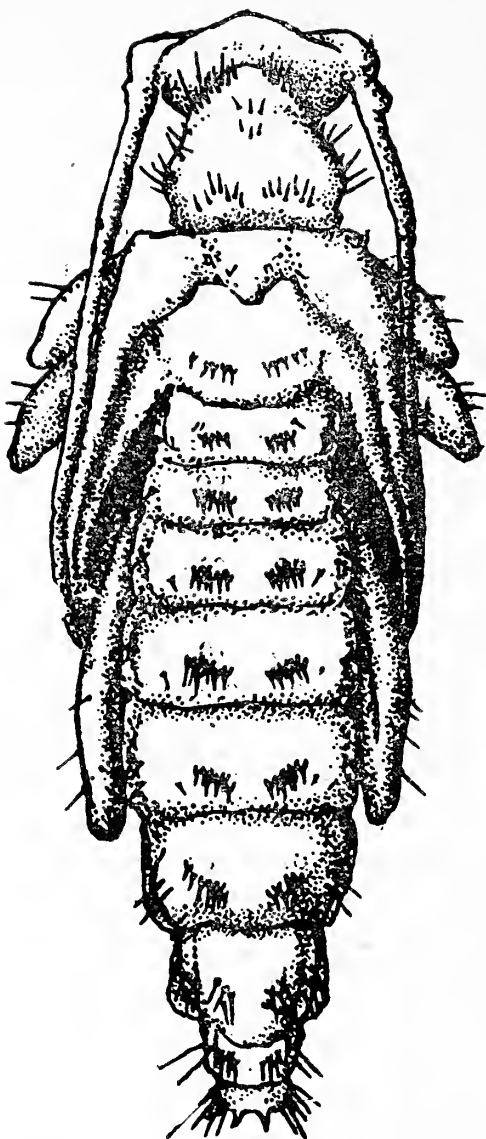


Figure 157. Pupa of *Strangalomorpha tenuis* Sols.

Material: Primor'e; beetles raised in laboratory 63, pupae four (two males, two females), larvae 21 (1971 to 1973). Over 150 beetles collected in nature and studied.

Distribution: Eastern Siberia from Zeya River to Pacific Ocean coast; northeast China, Korea, and Japan. Often found in broad-leaved forests of Ussuri-Primor'e region, sighted in Sakhalin. I found this species in the environs of Komarovka River, Primor'e biotope, Ovchinikovo, Lake Khanka, and Partizan.

Biology: *Strangalomorpha* thinly inhabit deciduous growths. Flight of beetles commences in first few days of June and continues up to end of July. En masse flight observed in second half of June. For example, of 152 beetles collected in three summer seasons, 11.9% were found in first 10 days of June, 57.2%—middle 10 days, 16.4%—last 10 days of June, 13.8%—first 10 days of July, and 0.7% at other times. Beetles often sighted on flowers gathering pollen and mating thereafter. Female
266 lays eggs in bark crevices of willow, bird-cherry, maple, walnut, oak,

elm, Schmidt's birch, Amur choke-cherry, alder, lilac, hazel nut, and other species. Colonizes trunks of dead trees up to 3.0 to 8.0 cm or more in diameter.

Embryonic development (egg stage) completed in two to four weeks, depending on temperature conditions. In forests on the banks of Komarovka River in 1972 larvae began hatching on July 7th from eggs collected June 3rd through 6th; in 1973 larvae began hatching on July 19 from eggs collected July 1st through 5th.

Young larvae live under bark, later penetrate deeper into wood, make longitudinal galleries there, and plug them with frass. Width of gallery about 4.0 mm. Sometimes population density so high that wood appears pierced throughout by such galleries. Pupal cell made at end of gallery, 20 mm long and up to 5.0 mm wide, along trunk surface or obliquely. Sometimes pupal cell penetrates bark, in which case anterior end usually sealed with plug of frass. Larvae hibernate twice. Preparation for pupation occurs before second hibernation and pupation commencing early spring.

Pupae maximum end of May. Pupa lies in cell with head toward anterior end (toward exit). Young beetles sighted in last few days of May and in June. They remain in pupal cells for about one week, make round openings 2.0 to 3.5 mm in diameter toward trunk surface, and exit through them. Emergence of beetles from cells commences early June and ceases by the end of this month. Life cycle completed in two years. Weight of larvae before pupation 31.8 to 60.5 mg, pupae 27.7 to 50.8 mg, and adult insects 22.1 to 43.4 mg. Weight loss during metamorphosis about 30%. Pockets of en masse reproduction of *Strangalomorpha* seen in forests littered with cuttings, damaged by fire, or decaying for some other reason. *S. tenuis* more often damages maple, hazel nut, alder, and Manchurian walnut.

7. Genus *Anoplodera* Muls.

Mulsant, 1839, *Coleopt. France, Longicorn*, p. 285; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 319-320 (*Leptura*); Gressit, 1951, *Longicorn Beetles of China*, vol. 2, p. 81.

Adult: Characterized by sharp cervix, less produced posterior angles of pronotum and large, markedly emarginate eyes.

Egg: Characterized by cellular sculpture, sometimes very distinct, sometimes slightly smoothened.

Larva: Locomotory ampullae developed on abdominal segments I to VII, with granules dorsally forming four transverse rows grouped into two transversely elongate ellipses (inner and outer) and two rows ventrally. Locomotory ampullae on segment VII less developed.

Pupa: Spinules present dorsally and pair of more or less developed urogomphi present on tip of abdomen.

Of the 39 species known in the USSR, about 15 inhabit northern Asia. I am not aware of *Anoplodera misella* Bat., *A. atramentaria sibirica* Plav., and *A. apicalis* Motsch. and did not find *Anoplodera sanguinolenta* (L.) east of the Urals. The preimaginal stages have been identified and the biology studied for nine species of this genus. Some species [*Anoplodera rufiventris* (Gehl.), *A. sequensi* (Reitt.)] are ecologically associated with coniferous species and others [*Anoplodera cyanea* (Gehl.)] with deciduous species. Some species [*Anoplodera variicornis* (Dalm.)] develop on deciduous as well as coniferous species of trees. A common feature of the genus as a whole is that all its species live on dead trees, mainly those damaged by rot. They do not attack viable trees.

Type species: *Leptura rubra* Linnaeus, 1758.

KEY TO SPECIES

Adult Insects

- 1 (10). Pronotum without constriction anteriorly, only with narrowly curved anterior margin.
- 2 (3). Elytra thicken behind scutellum, appear transversely impressed, with metallic blue, violet, or green tinge. 1. *A. cyanea* (Gehl.).
- 3 (2). Elytra not thickened near scutellum, more or less uniform.
- 4 (7). Pronotum elongate, not highly convex, broadens somewhat roundly in middle. Elytra black with yellow spots (female) or yellow with black apex and black spots laterally (male).
- 5 (6). Elytra with large punctation. Pronotum with erect hairs. 2. *A. rufiventris* (Gehl.).
- 6 (5). Elytra with minute punctation imparting matte tone. Pronotal disk without erect hairs. 3. *A. baeckmanni* (Plav.).
- 7 (4). Pronotum markedly convex, appears spherical in dorsal view. Elytra yellow throughout or rusty-yellow with large round black spot on disk.
- 8 (9). Elytra elongate, with large black spot medially on disk. 4. *A. bipunctata* (F.).
- 9 (8). Elytra short, not elongate, monochromatic, without spots medially on disk. 5. *A. livida* (F.).
- 10 (1). Pronotum with broad constriction anteriorly.
- 11 (24). Body with short sparse hairs that do not form compact cover. Elytra obliquely truncate or notched apically.
- 12 (13). Antennae variegate; 4th to 6th and 8th antennal segments

- with white ringlet basally. 6. *A. variicornis* (Dalm.).
- 13 (12). Antennae black or dark brown, without white ringlets at base of segments.
- 14 (17). Antennae serrate from 5th segment, with produced outer distal angle.
- 15 (16). Elytra slightly narrow posteriorly, broadly notched apically, red in female, straw-yellow in male. 7. *A. rubra* (L.).
- 16 (15). Elytra markedly narrow posteriorly, narrowly notched apically, red in male and female, identically colored. 8. *A. succedanea* (Lew.).
- 17 (14). Antennae not serrate, outer distal angle rounded, almost not produced.
- 18 (19). Pronotum and elytra matte, with dense minute punctation. 9. *A. scotodes* (Bat.).
- 19 (18). Pronotum and elytra not matte, more or less lustrous.
- 20 (21). Pronotum with short semiadherent hairs. 10. *A. sanguinolenta* (L.).
- 21 (20). Pronotum with dense sessile and some erect hairs.
- 22 (23). Elytra notched apically, with sharp outer angle, light colored, with reddish, rusty, or rusty-yellow tinge. Sometimes partly or almost entirely darkened. 11. *A. sequensi* (Reitt.).
- 23 (22). Elytra obliquely obtuse or slightly notched apically, with obtuse or rounded outer angle, black. . . 12. *A. renardi* (Gebl.).
- 24 (11). Body with long green hairs forming continuous dense cover. Elytra not notched apically, straight and obtuse. Antennae variegate, with light-colored ringlets commencing from base of 3rd segment 13. *A. virens* (L.).

Larvae

- 1 (2). Eusternum uniformly sclerotized; minute spinules impart shagreen or matte tone to entire surface. . . 1. *A. cyanea* (Gebl.).
- 2 (1). Eusternum coriaceous, lustrous; sclerotized spot seen only in some species laterally at base, where minute spinules impart brownish-yellow tinge.
- 3 (16). Epistoma without transverse white band anterior to middle; frontal sutures here without sharp flexure, usually straight.
- 4 (5). Eusternum with large thick setaceous hairs along entire triangular perimeter (along sides and on base), with small sclerotized spots at posterior angles. Presternum of prothorax with group of thick setaceous hairs on anterior margin. 2. *A. rufiventris* (Gebl.).
3. *A. baeckmanni* (Plav.).

- 5 (4). Eusternum without large thick or minute thin hairs on entire perimeter (present only along sides), and with or without sclerotized spot laterally at posterior angles. Presternum of prothorax without hairs or with stray hairs not forming tufts on anterior margin.
- 6 (9). Eusternum with sclerotized spots at posterior angles.
- 7 (8). Dorsal locomotory ampullae with three setae laterally between inner rows of granules; of these, two contiguous and inward, one lateral. Eusternum laterally with long setaceous hairs almost up to base. 8. *A. succedanea* (Lew.).
- 8 (7). Dorsal locomotory ampullae without lateral setae between inner rows of granules or with stray, barely visible setae. Eusternum laterally with long setaceous hairs only in anterior half. 7. *A. rubra* (L.).
- 9 (6). Eusternum without sclerotized spots at posterior angles, entirely coriaceous, not sclerotized.
- 10 (11). Granules of dorsal locomotory ampullae large. Epistoma with hairs of varying length, many short ones in between long ones; posterior two pairs of hairs not isolated, form together with other hairs common pubescent transverse field. 6. *A. variicornis* (Dalm.).
- 11 (10). Granules of dorsal locomotory ampullae minute. Epistoma with long identical hairs; posterior two pairs of hairs (inner and at suture) isolated and form transverse row.
- 12 (15). Hypostoma flat or slightly convex. Epistoma impressed along suture in posterior half.
- 13 (14). Head comparatively broad, 2.5 or almost 3.0 times wider than length along longitudinal suture of epistoma. 9. *A. scotodes* (Bat.).
- 14 (13). Head narrower, 2.0 times wider than length along longitudinal suture of epistoma. 12. *A. renardi* (Gehl.).
- 15 (12). Hypostoma bulges markedly, appears transversely dilated. Epistoma not impressed, convex or at most flat. 11. *A. sequensi* (Reitt.).
- 16 (3). Epistoma with white transverse band anterior to middle; frontal sutures here narrowly flexed. 13. *A. virens* (L.).

- 1 (2). Pronotum bulges markedly, spherical, with thin setae basally forming two triangular tufts separated by longitudinal groove in middle. 1. *A. cyanea* (Gehl.).
- 2 (1). Pronotum comparatively flat; if bulges spherically, with

spinules or setae basally forming only transverse row or band and not triangular tuft.

- 3 (16). Mesonotum with minute spinules, considerably smaller than spinules at base of pronotum.
- 4 (5). Urogomphi proximate at tip of abdomen, almost contiguous. Abdominal tergites VII to VIII glabrous on disk, large spinules only on posterior margin. 2. *A. rufiventris* (Gebl.),
3. *A. baeckmanni* (Plav.).
- 5 (4). Urogomphi neither proximate nor contiguous at tip of abdomen, or underdeveloped and not distinguishable from adjacent spinules.
- 6 (9). Pronotal disk with numerous minute spinules. Frontal tubercles at bases of antennae on inner side with three long spinules or spinescent setae.
- 7 (8). Abdominal tergite VIII with stray spinules (four to eight) forming transverse row. 7. *A. rubra* (L.).
- 8 (7). Abdominal tergite VIII with numerous spinules (up to 18) forming transverse band. 8. *A. succedanea* (Lew.).
- 9 (6). Pronotal disk glabrous or with sparse spinules; if with numerous spinules, frontal tubercles with five to nine spinules forming tuft.
- 10 (11). Pronotum without spinules on anterior margin, glabrous in front of transverse flange. 6. *A. variicornis* (Dalm.).
- 11 (10). Pronotum with spinules on anterior margin.
- 12 (13). Pronotum bulges markedly, sharply bent at anterior margin and here with acute acicular spinules forming dense transverse row. 9. *A. scotodes* (Bat.).
- 13 (12). Pronotum bulges moderately, not bent at anterior margin, only raised, and here with stray setae not forming transverse row.
- 14 (15). Urogomphi on tip of abdomen weakly developed, not distinguishable from adjacent spinules. 12. *A. renardi* (Gebl.).
- 15 (14). Urogomphi on abdominal tip distinct, widely separated, 2.0 times larger than adjacent spinules. 11. *A. sequensi* (Reitt).
- 16 (3). Mesonotum with large spinules, not smaller than spinules at base of pronotum. 13. *A. virens* (L.).

1. *Anoplodera cyanea* (Gebl.)

Gebler, 1832, *Nouv. Mem. Soc. Nat. Moscou*, vol. 2, p. 70 (*Leptura*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 327-328 (*Leptura*).

Adult (Figure 158): Readily distinguished from other species of the genus by metallic-green, bluish-violet, or bronze iridescence of elytra. Head behind occiput uniformly rounded; with dense deep punctation,

short prominently punctate, coarsely pubescent temples insignificantly raised at antennal bases, with narrow sharp smooth cervix. Antennae with 11 segments; apices reach beyond 0.50 (female) or 0.66 (male) length of elytra; matte in distal half; 3rd antennal segment longer than 4th, equal to 5th.

Pronotum bulges spherically on disk, with deep but not very dense punctation and long erect hairs, narrowly rounded anteriorly, transversely impressed like inverted tubercle at base, sometimes with smooth median longitudinal band in posterior half. Scutellum small, rounded posteriorly, more or less impressed longitudinally in middle.

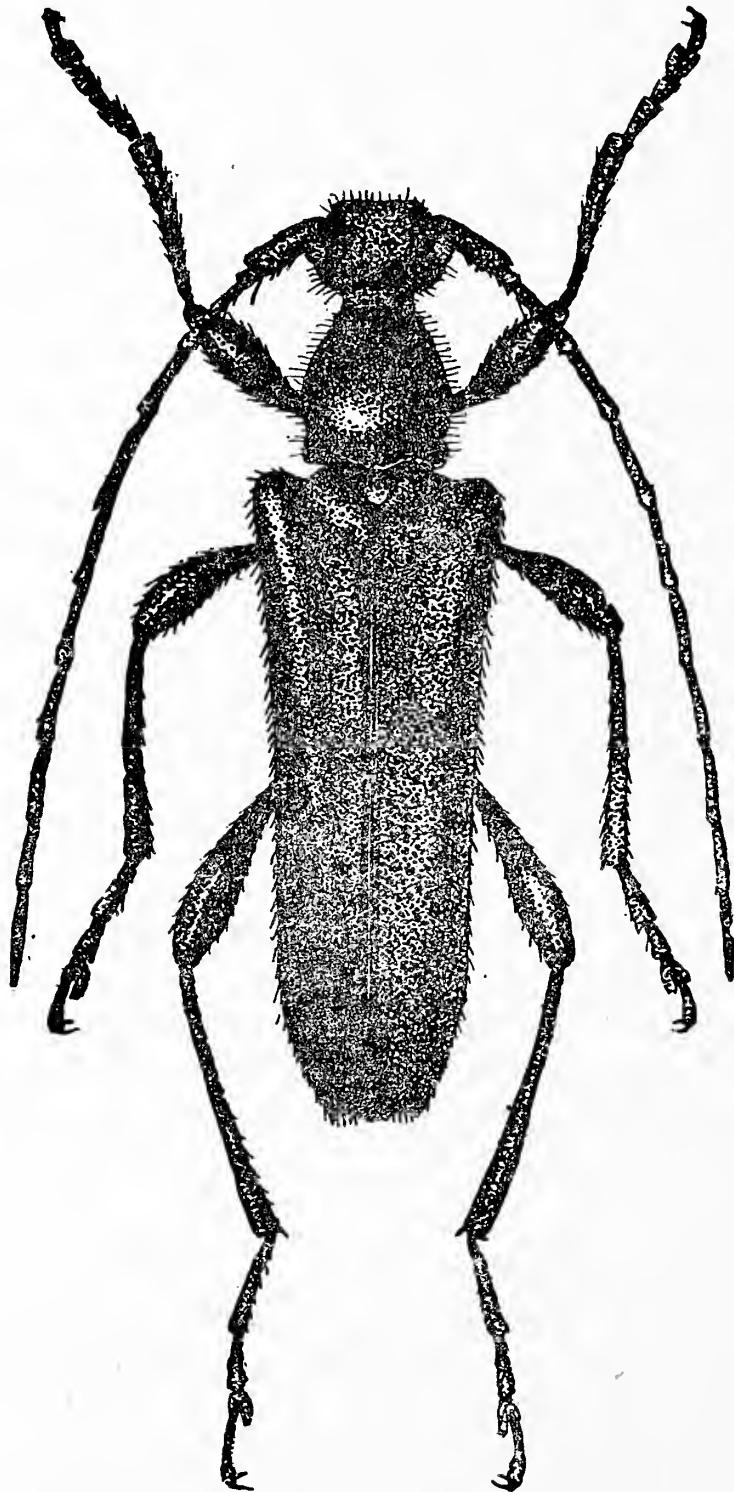


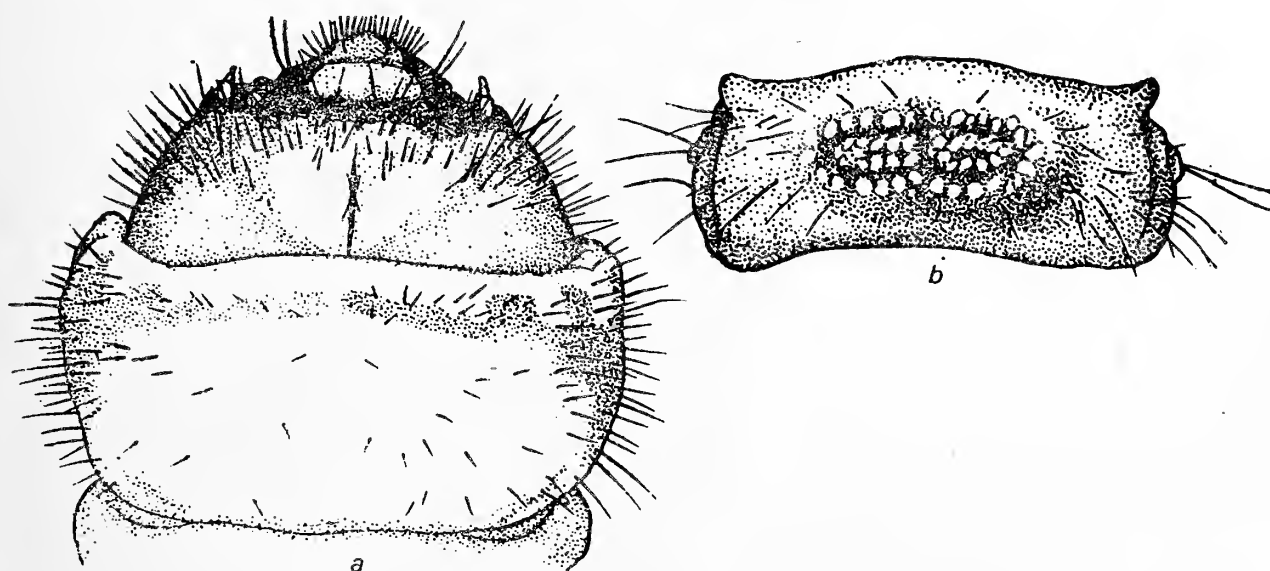
Figure 158. *Anoplodera cyanea* (Gebler).

Elytra elongate, impressed transversely behind scutellum and hence basally raised, wartlike, with fairly perceptible ridge extending from humeral tubercle, impressed longitudinally on disk at suture, truncate or faintly notched apically, with produced inner angle, and with large deep punctation and semiadherent brownish hairs. Body dark blue. Elytra with blue, green, violet, or bronze metallic iridescence. Body length of male and female 10 to 16 mm.

Egg: White, matte, with minute noncellular sculpture, papilliform at one pole and narrowly rounded (almost pointed) at the other. Length 1.4 mm, width 0.4 mm.

Larva (Figure 159): Body narrows posteriorly from thorax. Head bent downward, insignificantly retracted into prothorax, narrows anteriorly, with one small ocellus laterally at base of antennae. Epistoma triangular, with numerous piliform setae in anterior half, more or less distinct frontal sutures laterally, and median longitudinal suture that is entirely brownish. Hypostoma bulges slightly, almost flat, slightly narrows anteriorly, with white longitudinal gular band in middle, and numerous long setae. Clypeus large, trapezoidal, white, brownish-rust at base. Labrum transversely elongate, broadly rounded at anterior margin, with dense setae, glabrous at base and on disk. Mandibles obliquely notched apically, with acute elongate lower denticle, and two carinae on inner side proceeding from apex.

Pronotum bulges slightly, flat on disk, broadens somewhat anteriorly, with sparse (almost stray) uneven thin hairs laterally and in anterior half. Pronotal shield white, fuses with general surface of pronotum, without lateral longitudinal grooves. Prosternum with long hairs; eusternum uniformly sclerotized, with yellow tinge. Thoracic legs comparatively slender, with well-developed claws.



- 271 Abdomen elongate, with sparse stray hairs laterally. Dorsal locomotory ampullae bulge markedly, with deep median longitudinal groove, and fine granules forming four transverse rows in form of two ellipses—inner and outer. No sclerotization perceptible between granules. Ventral locomotory ampullae with two rows of granules that diverge outwardly. Body white, head rusty, anterior margin of pronotum with yellow transverse band. Length of body up to 22 mm, width of head 3.0 mm.

Pupa (Figure 160): Characterized by arrangement of setae on pronotum, presence of widely separated straight urogomphi on tip of abdomen, and other features. Head markedly bent under, elongate anteriorly, narrows somewhat and spherically rounded on occiput; with stray or paired setae laterally on anterior margin between upper lobes of eyes and around antennal bases, and six setae at base of clypeus forming transverse row. Antennae flexed to sides, arcuate.

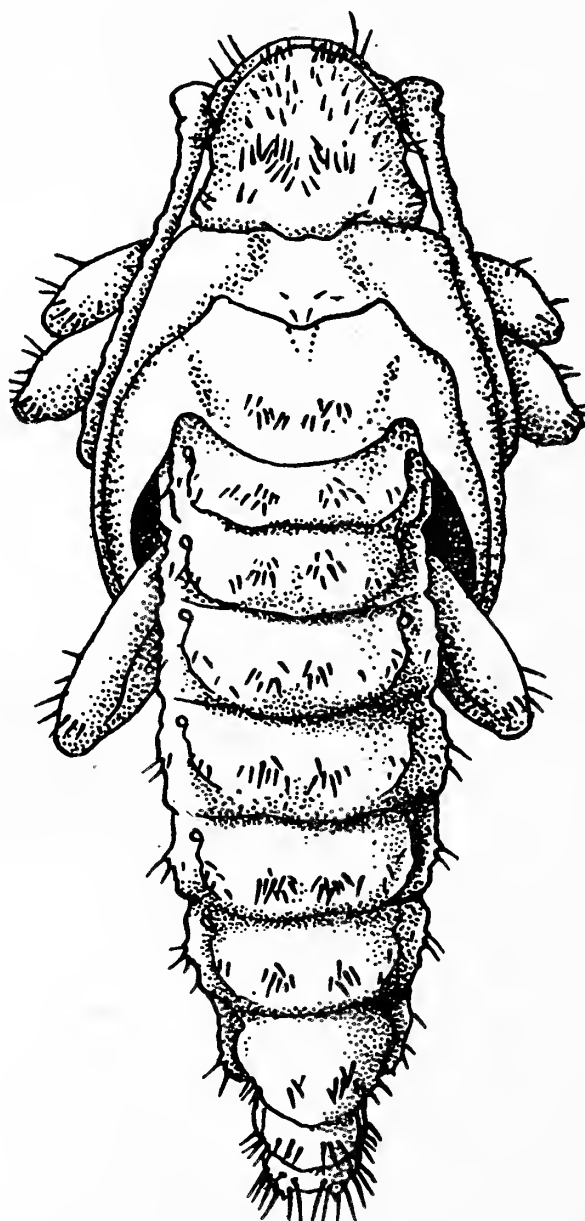


Figure 160. Pupa of *Anoplodera cyanea* (Geb.).

Pronotum somewhat elongate, bulges uniformly, narrows somewhat anteriorly, with straight or slightly rounded, nonproduced posterior angles; thin setae on protuberant coriaceous base form transverse band on anterior margin, widely diffuse setae on disk; triangular basal field narrows posteriorly and interrupted medially by longitudinal groove. Mesonotum with two setae on anterior margin, with transverse short dashes between them forming transverse band, and pair of widely separated setae behind middle. Metanotum convex, broadly rounded posteriorly, 272 with acicular (setaceous) spinules behind middle forming transversely elongate continuous field interrupted medially by indistinct clearance. Hind femora (dorsal view) with long thick setae forming transverse row apically and longitudinal row laterally.

Abdomen elongate, broadens somewhat in region of segment IV, gradually narrows posteriorly. Abdominal tergites bulge, with narrow median longitudinal groove, and setaceous spinules laterally removed from groove and set on protuberant coriaceous base forming small tufts (five to seven spinules per tuft). Tergite IX at posterior margin with pair of widely separated straight urogomphi that terminate in acute, slightly sclerotized spinule. Tip of abdomen (ventral view) obtuse, laterally bound by carinae set with long setae in protuberant base. Length of body 12 to 15 mm, width of abdomen 3.0 mm.

Material: Collected in Ussuri-Primor'e region and in Kunashir. Adult insects 57, larvae 20, and pupae two (male).

Distribution: From Baikal to Kamchatka, Kuril' Islands, Sakhalin; Japan, Korea, northeast China, northern Mongolia. I found it common in Ussuri-Primor'e region.

Biology: *Anoplodera cyanea* belongs to relict fauna prevalent in the Tertiary period. It is ecologically associated with broad-leaved forests. Flight from June through August. In Ussuri-Primor'e region beetles maximum in second half of June and early July. During the systematic collection of 57 beetles, 5.0% were found in first half of June, 34%—second half, 51%—first half of July, 9.0%—second half of July, and 1.0%—early August. In Kunashir in 1974 beetles were sighted in large numbers in July and early August. Beetles often seen on flowers of Umbelliferae and other plants. Female lays eggs on bark of dead trees. Colonizes elm (*Ulmus*), maple (*Acer*), oak (*Quercus*), and other wood species. Fecundity comparatively low. Ovaries of one female that had not yet begun oviposition contained 45 eggs on the 14th day after her emergence. Egg stage continues for about 20 days. For example, larvae began hatching on July 17 from eggs laid on June 26 through June 29.

Larvae live in wood and plug galleries [with frass. Mature larva makes cell at end of gallery and pupates in it. Length of cell up to 30

mm, width up to 7.0 mm. Pupation commences early June and ceases end of June or early July. Developing beetles nibble round holes (5.0 mm in diameter) on trunk surface one week later and exit through them. Weight of larvae before pupation reaches 45.8 to 97.6 mg, pupae 43.7 to 92.6 mg, and beetles before emergence from wood 36.5 to 74.3 mg. This species sometimes colonizes trees infested by *Callipogon relictus* Sem.

2. *Anoplodera rufiventris* (Gebler)

Gebler, 1830, *Ledebour Reise*, vol. 2, p. 193 (*Leptura*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 331–333 (*Leptura*); Gressitt, 1951, *Longicorn Beetles of China*, vol. 2, p. 89.

Adult (Figure 161): Readily distinguished by variable pattern of elytra and color of abdomen in male. Body elongate (male) or comparatively thick (female). Head between upper lobes of eyes with transverse dent, narrow median longitudinal suture, dense large punctures (spaces between them narrow, like septa), and long erect light-colored hairs very dense on temples and in region of frons, and sharp cervix. Antennae reach beyond middle of elytra (female) or barely reach elytral apex (male). First antennal segment thick, with very large dense punctation; 2nd transverse; 3rd longer than 4th, equal to 5th.

Pronotum notably elongate (male) or basal width not more than length (female), with more or less produced posterior angles, compressed more (male) or less (female) laterally in posterior half, notably narrows anteriorly, and with median longitudinal groove; with very dense, comparatively uniform punctation, long erect hairs, narrow flange on anterior margin, and transverse groove at base. Scutellum moderately elongate, triangular, narrowly rounded apically; with dense large punctation and sparse adherent hairs. Elytra with parallel sides (female) or narrow gradually from base to apex (male), convex, individually rounded apically, with obtuse inner and more tapering outer angle, dense rugose punctation and short semiadherent yellowish hairs. Femora gradually thicken from base to apex. Hind tarsi not shorter than tibiae, their 1st segment longer than successive two. Body ventrally with light-colored semiadherent hairs.

Abdominal sternite V rounded (female) or broadly notched (male) at posterior margin. Abdominal tergite V obtuse (male) or with narrow notch (female) posteriorly. Body black, abdomen in male red, in female black. First antennal segment black, remainder reddish-rust, blackened apically. Elytra in male rusty-yellow, with black spot laterally behind middle and at humeri, with blackened apex in posterior third, sometimes with yellowish alveolus on hind clivus, quite often with blackened margin. Elytra in female black, with yellowish spots basally, laterally

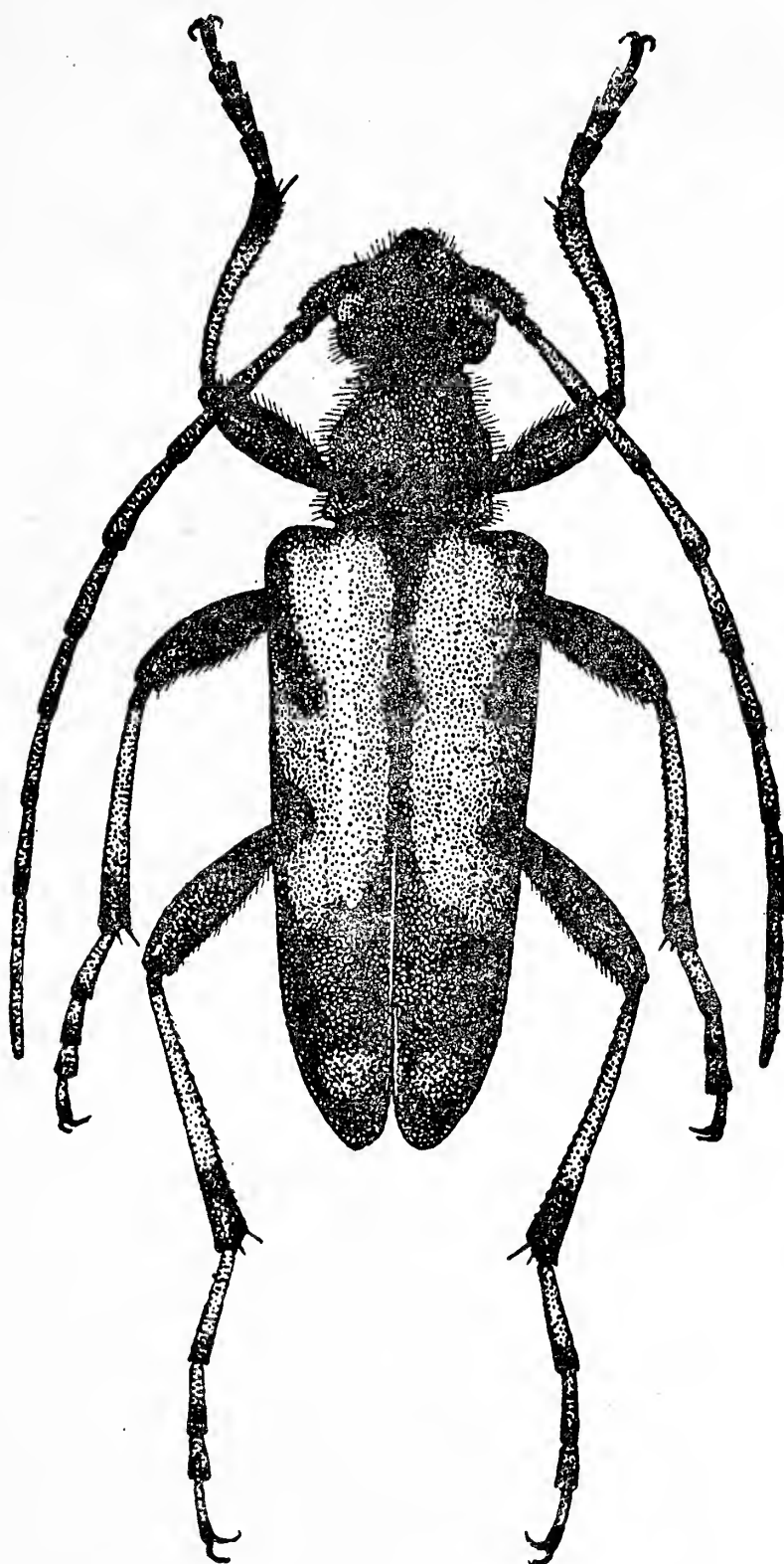


Figure 161. *Anoplodera rufiventris* (Gebf.), male.

on hind clivus, and medially at suture. Latter spot longitudinally elongate, others rounded, oval, or angular. Elytral pattern highly variable; rarely elytra entirely black. Length of body 8.0 to 13.0 mm (male), 11 to 14 mm (female).

Egg: White, elongate, obtuse at one pole, narrowly conical at the other, with flat cellular sculpture. Cells five- or six-faceted, spaces between them narrow, like septa. Length 1.9 mm, width 0.4 mm.

274 *Larva* (Figure 162): Body elongate. Head somewhat bent downward,

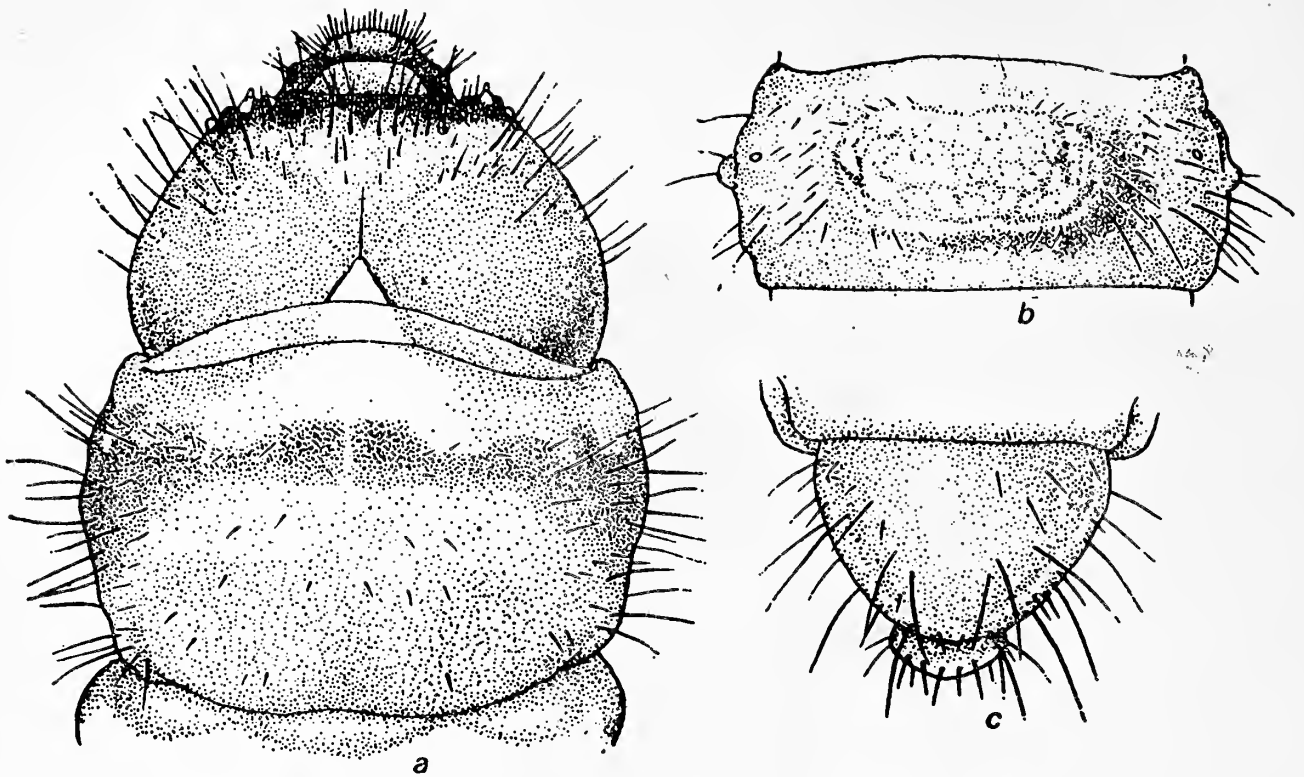


Figure 162. Larva of *Anoplodera rufiventris* (Geb.).

a—head and pronotum; b—abdominal tergite with locomotory ampulla;
c—tip of abdomen.

rounded toward base, gently narrows anteriorly, with long and short setaceous hairs laterally in anterior half, and convex hyaline ocellus at antennae on underside. Epistoma triangular, pointed posteriorly, with long and short rusty setaceous hairs forming median transverse field, two close-set setae on angles bent downward and forward, and six large thick hairs on anterior margin; frontal sutures narrow, distinct, longitudinal suture dark brownish, smooth in middle. Hypostoma slightly convex, almost flat, insignificantly narrows anteriorly, rounded at anterior angles, with white median longitudinal band, and long setae, seven to ten on each side of band. Clypeus convex, smooth, rusty, trapezoidal at base, with stray setae along angles. Labrum transversely oval, broadly rounded at anterior margin; with sparse short setae, lustrous basally, and rusty-brown. Apices of mandibles broadly notched obliquely, with long produced, rostriform, lower denticle (viewed from inner side), short triangular upper denticle, and transverse carinate fold on inner side extending from middle of upper margin to apex of lower denticle.

Pronotum transverse, slightly convex, with sparse setaceous hairs in anterior half of yellow band forming transverse field, and diffuse hairs behind this band usually forming two indistinct rows. Pronotal shield without longitudinal folds, white, with faint striation. Prosternum convex, lustrous, with transversely elongate sclerotized round spot at base, and thick setaceous hairs laterally. Presternum coarsely striate, lustrous,

with uniformly arranged short thick hairs. Propresternum sclerotized, shagreen, with group of hairs only posteriorly forming indistinct transverse row. Legs well developed, with acute dark brown claw.

275 Abdominal tergites laterally with sparse, not very long hairs. Dorsal locomotory ampullae bulge, with median longitudinal groove; four rows of granules forming two dense transverse ellipses not interrupted medially, one each on inner and outer side. Spaces between rows of granules sclerotized, with minute spinules visible under high magnification. Only inner ellipse present on tergite VII, outer one lacking. Ventral locomotory ampullae with two transverse rows of lustrous round or slightly elongate granules and transverse sclerotized band anteriorly. Sternite VIII in middle and IX along posterior margin with long setaceous hairs forming transverse field. Body white, head rusty, mandibles blackish-brown, anterior half of pronotum with transverse rusty-yellow band interrupted medially by narrow white field in which deep lateral notch occurs on anterior margin. Length of body 26 to 30 mm, width of head up to 4.5 mm.

Pupa (Figure 163): Body somewhat curved. Head slightly elongate anteriorly, transversely convex between antennae, usually with six to ten setae on anterior margin forming transverse row, four setae at base of antennae on inner side, and pair of thick setae behind eyes on lateral tubercles. Antennae flexed to sides, bent annular in distal half (male) or only apices bent ventrad (female).

Pronotum bulges uniformly, narrows in anterior half, with rounded angles; setae at base form transverse band narrowly interrupted medially, in posterior half and anteriorly on disk with stray short setae. Meso- and metanota with short sparse or numerous setae (especially on metanotum) forming single paramedial tuft.

Abdomen elongate, slightly enlarged in region of segments III to VI. Abdominal tergites convex, with indistinct median longitudinal groove, acicular spinules in posterior half forming transverse band interrupted medially. Abdominal tergite VII longitudinally (female) or transversely (male) elongate, with numerous spinules on posterior margin. Tip of abdomen slightly bent under, with two urogomphi terminating in sharp sclerotized spinule, obtuse ventrally, and bound laterally with horseshoe-shaped carina. Valvifers of female spherical, contiguous, produced into lateral papilliform process apically. Length of body 11 to 20 mm, width of abdomen 3.5 to 5.0 mm.

Material: From Altai, Salair, and Tuva. Beetles 96, of which 87 raised in the laboratory, larvae 298, pupae—13 males and females.

Distribution: Altai, the Sayans, northern Mongolia. Common in Lake Telets region. Extends in mountains up to 2,000 m or more, i.e., up to boundaries of wood species.

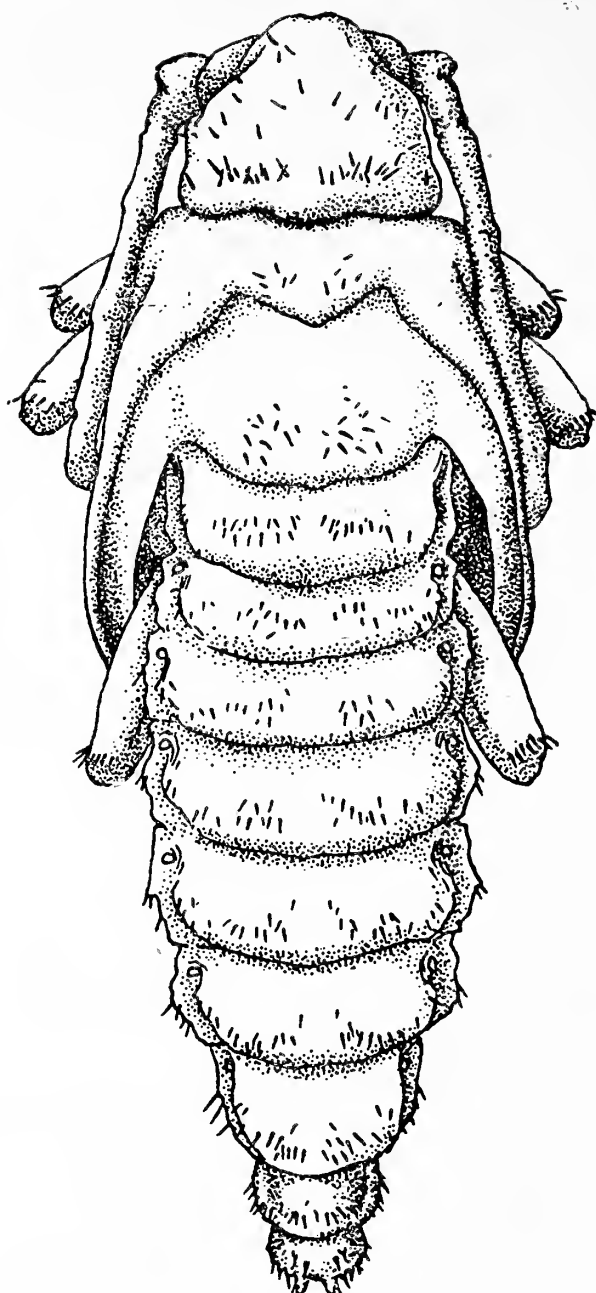


Figure 163. Pupa of *Anoplodera rufiventris* (Gebler).

- 276 *Biology*: Inhabits coniferous forests. Large numbers sighted in fir—maple forests in Ayukol' near Lake Telets. Beetles seen in early July, disappear end of August. Lead a cryptic mode of life. Rarely found on flowers. Soon after emergence from wood they mate and female lays eggs mainly on old dead fallen Siberian stone pine (*Pinus sibirica*) and fir (*Abies sibirica*), quite often covered with moss. Ovaries of one virgin female, dissected 10 days after emerging from wood, contained 240 mature eggs; of another 234 eggs; and yet another 190 eggs five days after emerging from wood. Female lays eggs in bark crevices or wood fissures. Developmental period of eggs in nature at $18.5 \pm 0.6^{\circ}\text{C}$ ranged from 14 to 22 days, average 17.1 ± 0.2 days, and in the laboratory at $17.1 \pm 0.4^{\circ}\text{C}$ from 14 to 24 days, average 18.2 ± 0.1 days. In nature 234 eggs and in the laboratory 141 were kept under constant observation.

Larvae live in upper layer of wood, make longitudinal straight or meandering galleries, and plug them with frass. Sometimes galleries widen into platforms. If upper layer of wood damaged by fungus, larvae penetrate adjoining unaffected area. Mature larva makes pupal cell at end of gallery along or across trunk, sometimes oblique to surface. Cells generally made in dense wood not damaged by fungus. Width of gallery 8.0 to 15.0 mm; length of pupal cell 18 mm, width 8.0 mm.

Pupation commences in June and ends in second half of July. At 13.6 to 21.4°C pupae develop in 17 to 18 days. Pupae maximum in early July. Emergence of beetles commences by this time. Five to seven days later young beetles nibble round openings up to 5.0 mm in diameter on trunk surface and exit through them. Emergence of beetles from wood ceases in last few days of July or in early August. In Altai on July 25, at a height of 2,000 m five adults, five pupae, and one larva before pupation were found on a maple stump. Weight variation during metamorphosis is exemplified by these three female specimens: total weight of larvae before pupation 474 mg (100%), pupae 368.4 mg (77.7%), and adults after emergence from wood 293.3 mg (61.4%). Females markedly larger. Weight of adult females immediately after emergence from wood ranges from 88 to 176 mg (average weight 130.8 ± 7.0 mg) and males from 33 to 70 mg (average weight 49.6 ± 3.0 mg). Population density in wood comparatively high. For example, on a dead fallen maple 20 cm in diameter, 31 insects of this species were recovered from every meter length. *Anoplodera rubra* (L.), *A. virens* (L.), and sometimes *Cornumutilla quadrivittata* (Geb.) live together with this species.

3. *Anoplodera baeckmanni* (Plav.)

Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 333-353 (*Leptura*).

Adult: Body moderately elongate. Head somewhat elongate anteriorly, cervix behind temples not sharp, with dense matte punctation, smooth median longitudinal band, and large sharp punctation in cervical region. Temples long, project, with long yellowish hairs. Antennal apices extend beyond middle of elytra; 3rd antennal segment longer than 4th, almost equal to or only slightly shorter than 5th.

Pronotum elongate, with broad perceptible flange on anterior margin, slightly produced posterior angles, dense large punctation, median longitudinal groove, smooth facet on hind clivus, and sparse light-colored short hairs.

Elytra elongate, with parallel sides or narrow somewhat posteriorly, rounded apically, with projecting humeri, minute notched punctation, faint adherent hairs, and matte. Hind femora thicken gradually toward apex, barely reach posterior margin of abdominal sternite III. Hind tarsi

shorter than tibiae. Body black, elytra with yellow spots: one round spot laterally on scutellar base anterior to middle, elongate spot behind middle on suture joining posteriorly with transverse light-colored band, elongate spot on hind clivus of suture, and round spot laterally (f. *typica*). Sometimes spots merely small nicks and transverse band absent (ab. *julii* Plav.). Length of body 12.5 mm.

Distribution: Primor'e. Described from collection of the Zoological Institute, USSR Academy of Sciences (Leningrad) and the Zoological Museum, Moscow State University (Moscow).

4. *Anoplodera bipunctata* (F.)

Fabricius, 1781, *Species Insect.*, p. 245 (*Leptura*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 340-341 (*Leptura*).

Adult (Figure 164): Characterized by elytra posteriorly narrower, with rounded apices and round black spot. Head with moderately small punctation, erect hairs, sharp cervix, and very short temples. Antennae in female barely reach middle of elytra, in male extend notably beyond it, and matte from 7th segment onward.

Pronotum bulges spherically, markedly narrows anteriorly, with sharp flange on anterior margin, transverse broad groove at base, uneven punctation, erect yellow hairs, and slightly lustrous. Scutellum short, triangular, with minute, rather sparse punctation.

Elytra markedly narrow posteriorly from humeri, apically rounded individually, comparatively bulge notably, lustrous; with minute punctation and light-colored or light yellowish long hairs. Body black, elytra yellow [*A. b. bipunctata* (F.)] or red [*A. b. mulsantiana* (Plav.)], with large round black spot in middle, sometimes with blackened apex and with blackened suture [ab. *zubkovi* (Plav.)]. Length of body 8.5 to 13.0 mm.

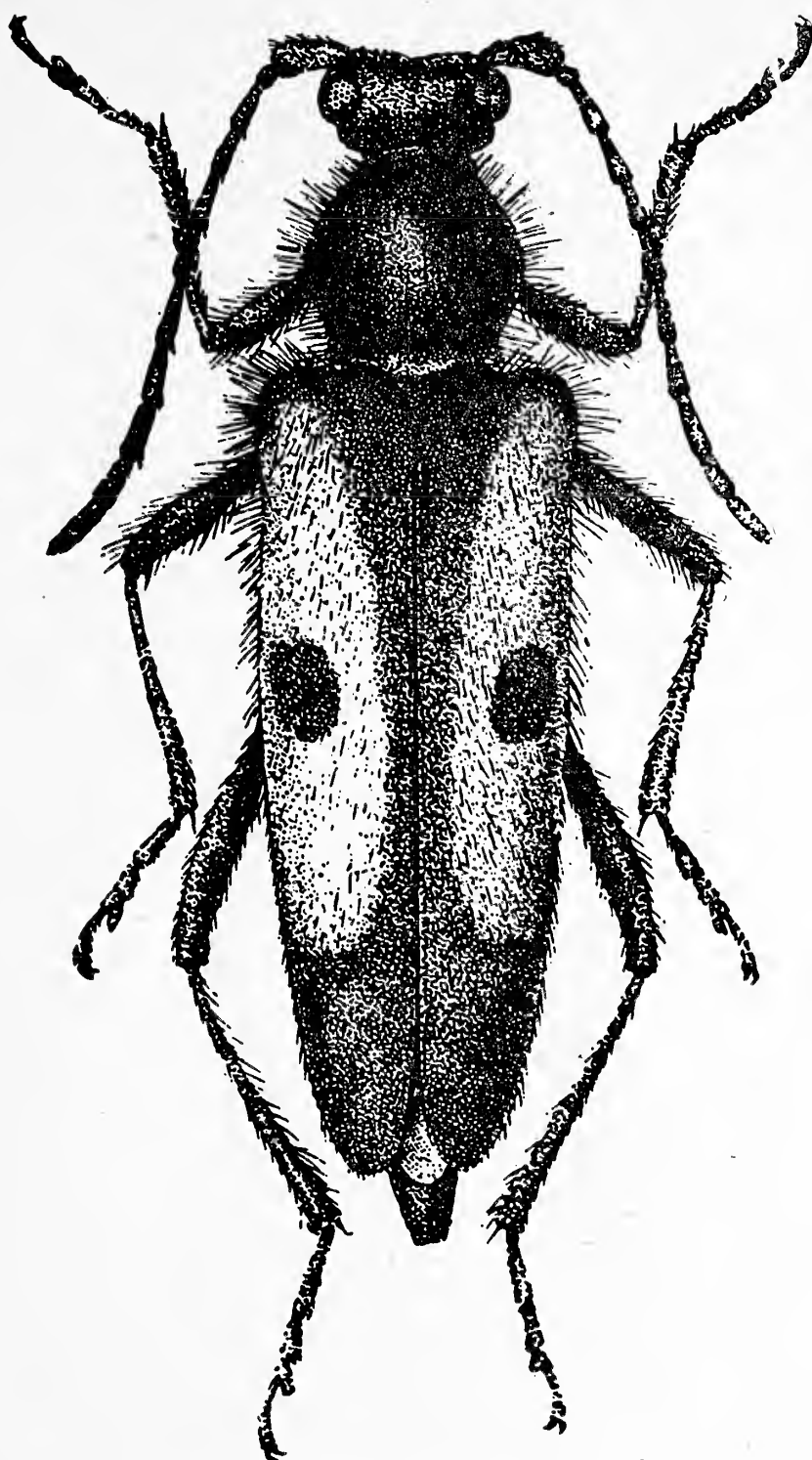
278 *Material*: Numerous beetles. Kustanai, June 7th through 16th, 1914. Collection of the Zoological Institute, USSR Academy of Sciences (Leningrad).

Distribution: Southern regions of European part of the USSR, from Prut to the southern Urals inclusive.

5. *Anoplodera livida* (F.)

Fabricius, 1776, *Species Insect.*, p. 233 (*Leptura*); *pecta*, Daniel, 1891, *Coleopt Stud.*, vol. 1, p. 38; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 344-347 (*Leptura*).

Adult (Figure 165): Differs notably in bulging pronotum, and smooth area in middle of metathorax bound laterally by longitudinal carinate prominence (male). Body stocky, short. Head with dense round punctation, sometimes with smooth median longitudinal band, with rusty



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Figure 164. *Anoplodera bipunctata* (F.).

hairs, sharp cervix behind eyes, and short suspended temples. Antennae extend slightly beyond middle of elytra (male) or do not reach this level (female), thicken toward apex, and matte from 7th segment; 11th segment comparatively long and pointed apically.

Pronotum bulges spherically, narrows more at anterior margin, with narrow groove here, slightly curved border, and rounded posterior angles; with deep round punctation, long rusty semiadherent hairs bent downward laterally and posteriorly from middle (f. *typica*) or, contrarily, from sides medially and posteriorly (ssp. *pecta* Dan.). Scutellum triangular, bulges somewhat, with minute punctation and rusty hairs.

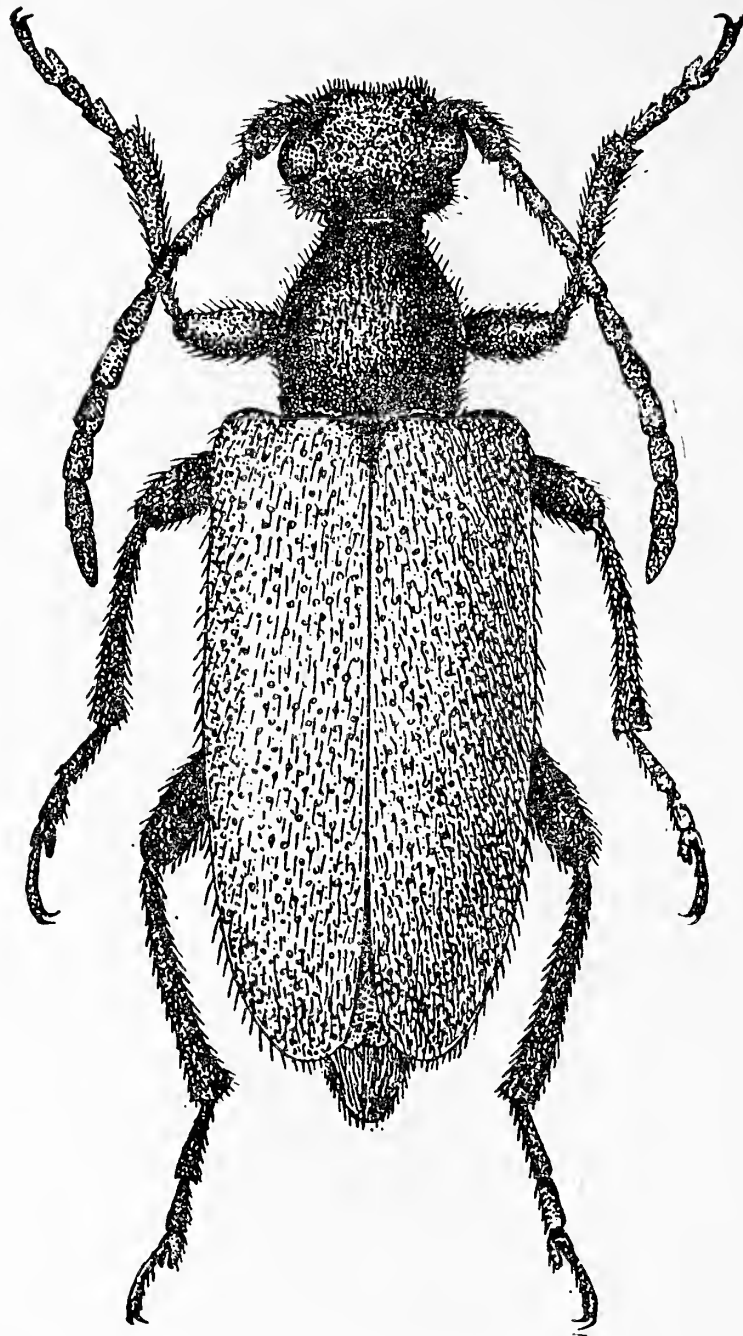


Figure 165. *Anoplodera livida* (F.).

Elytra convex, more elongate in male, broadly rounded individually at apex, appear obtuse; with projecting humeri, light-colored or rusty semiadherent hairs, and dense punctation. Underside with minute punctation and light-colored adherent hairs. Metathorax bulges in female, without lateral longitudinal carinae; smooth median area in male bound laterally by longitudinal upright carinae. Femora thick; hind tibiae equal to hind tarsi (female) or slightly longer (male). Body black, antennae and legs with brownish or rusty tone. Tarsi sometimes lighter in color. Elytra straw-yellow or rusty with yellow tinge. Abdomen black (f. *typica*) or red (ab. *bicarinata* Arn.). Length of body 6.0 to 7.0 mm.

Egg: White, oval, narrows toward poles, and narrowly rounded at ends; with flat cellular sculpture. Length 1.0 mm, width 0.3 mm.

279 *Larva* (Figure 166): Distinguished from larvae of other species of this genus by short hypostoma. Head somewhat retracted into prothorax, with parallel sides. Epistoma bound laterally by weak frontal sutures, medially divided by brownish longitudinal suture, with darkened border on anterior margin. Hypostoma with parallel sides, transversely 4.0 times wider than lateral length, and broadly emarginate basally. Dorsal and ventral locomotory ampullae well developed on abdominal segments I to VI. Pleural tubercles with three long thin hairs. Tip of abdomen with numerous long hairs. Described on the basis of I-instar larva.

Material: From Trans-Urals, Baraby, Upper Ob' region, and Tuva. Adult insects 2,042 and I-instar larvae raised in the laboratory five.

Distribution: From Atlantic Ocean coast to Baikal. Common in Siberia in foothills of the Urals, Altai, and Upper Ob' region.

Biology: Inhabits deciduous forests of forest-steppe zone, and foothills. Extends in mountains up to a height of 1,000 m. Flight of beetles from June through August. In 1977 in Novosibirsk flight commenced in last few days of June with beetles maximum mid-July. Thus of 1,769 beetles collected in one season, 30.3% were found in first 10 days of July, 46.5%—middle 10 days, 13.7%—last 10 days of July, and 9.5%—in August. Beetles most active in warm clear weather, hide after sundown. More often sighted in clearances warmed by sun, avoid shade. Feed on pollen of flowers. Ovaries of one female removed from a flower

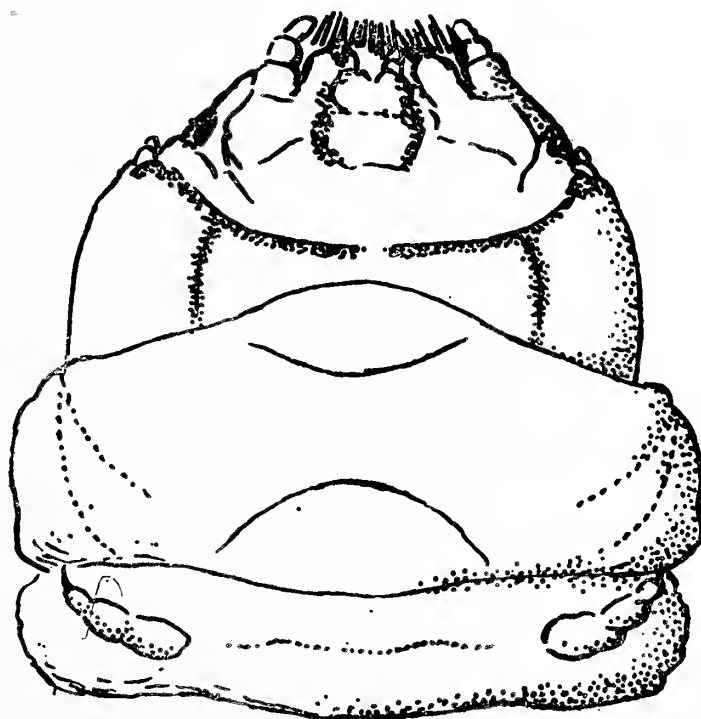


Figure 166. Larva of *Anoplodera livida* (F.).
Head and prothorax (ventral view).

contained 12 eggs. Embryonic development continues for up to two weeks. Under laboratory conditions, at $23.2 \pm 0.2^{\circ}\text{C}$ larvae hatched in 10 to 17 days (average 12.5 ± 0.1 days) after oviposition. A total of 192 eggs were kept under observation. Larvae which had colonized shoots of birch and other wood species perished. Weight of beetles feeding on flowers varied from 7.6 to 23.7 mg.

6. *Anoplodera variicornis* (Dalm.)

Dalman, 1817. In Schoenherr's *Syn. Ins.*, vol. 1, p. 3 (*Leptura*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 359–360 (*Leptura*); Cherepanov and Cherepanova, 1975, *Zhuki-drovoseki ivovyykh lesov Sibiri*, pp. 65–68 (*Leptura*).

Adult (Figure 167): Readily recognized by red-colored elytra and light-colored ringlets on antennae. Body of female stocky, broad at shoulders, more elongate in male. Head with dense coarse punctation, frons uniform in male, tubercularly raised around bases of antennae in female, and with sharp cervix behind temples. Eyes slightly emarginate, convex. Apices of antennae in female extend beyond 0.50, in male beyond 0.66 length of elytra; serrate from 5th to 10th segments, produced at outer apical margin, and with additional 12th segment at tip.

280 *Pronotum* bulges, narrowly rounded anteriorly, with transverse trough-shaped flange on anterior margin, and transverse deep groove at base; with dense large punctation, fused here and there, and dense long erect hairs. Scutellum triangular, pointed apically.

Elytra bulge, broad in female, more elongate in male, narrow toward apex, with rather smooth, slightly rugose punctation, indistinct humeral tubercles, and short semiadherent hairs; truncate apically, outer and inner angles sometimes slightly produced. Abdomen in female thick, sternite V elongate, truncate posteriorly. Abdomen in male thin, sternite V broadly notched apically, produced at posterior angles. Body black. Antennae black; bases of 4th to 6th and 8th segments with white, slightly yellow ringlets. Seventh antennal segment entirely black or sometimes in female with faint narrow white ringlet at base. Elytra red, sometimes straw-yellow. Length of body 14 to 23 mm.

Egg: Markedly elongate, thin, rounded at one pole, papilliform at the other, white; cells five- or six-faceted. Length 2.0 mm, width 0.5 mm.

Larva (Figure 168): Distinguished by median longitudinal dent on epistoma. Body comparatively thick, narrows abruptly on abdominal segment IX. Head transverse, slightly bent downward, narrowly rounded anterolaterally. Epistoma triangular, bound laterally by distinct whitish frontal sutures, impressed medially in region of frontal suture, with long hairs in anterior half. Hypostoma compact, with parallel sides, and hairs

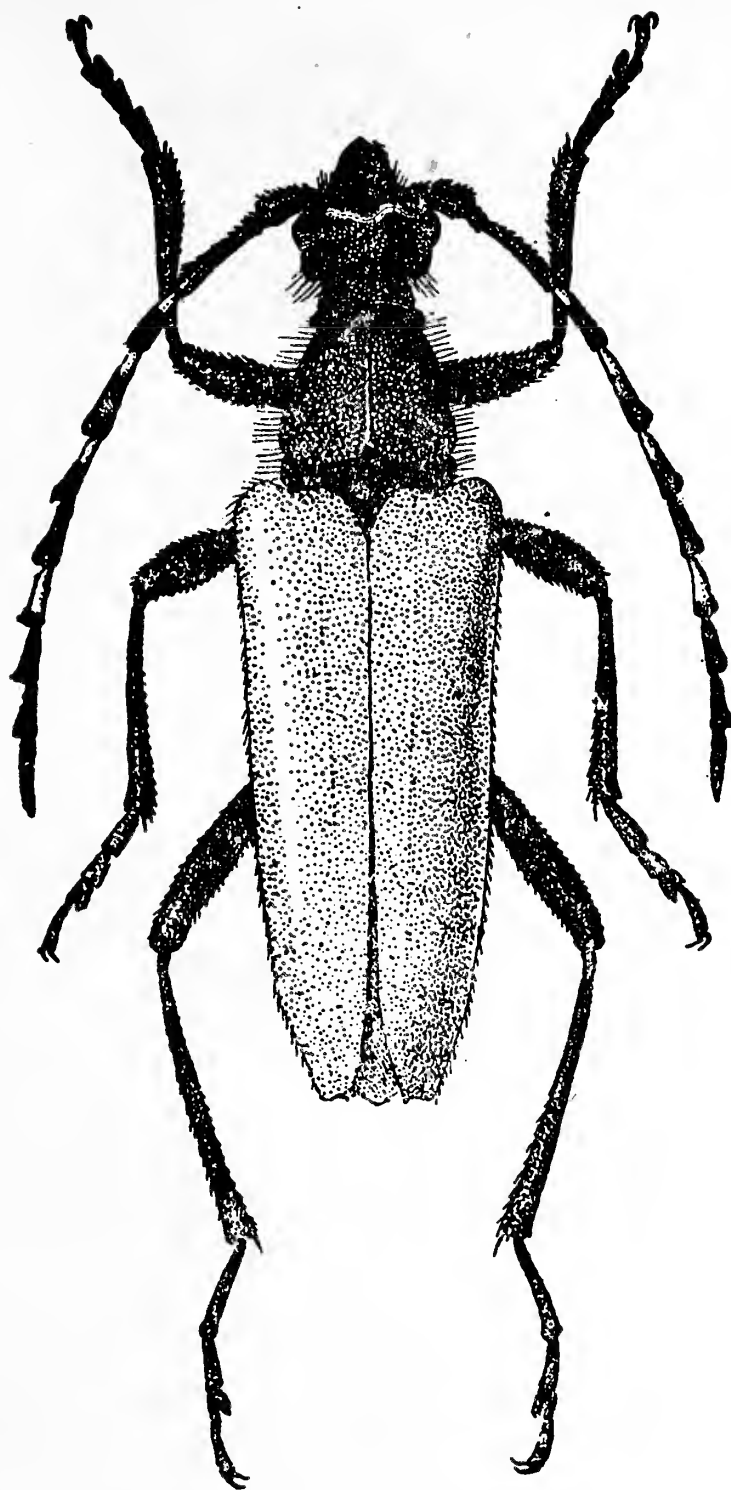
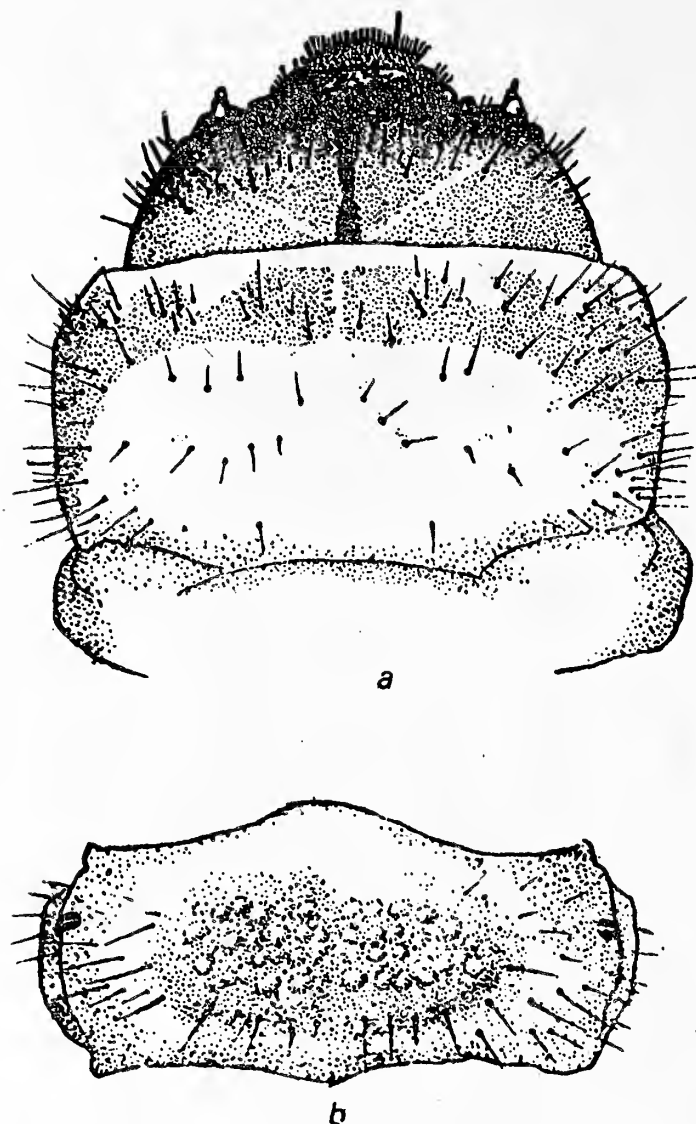


Figure 167. *Anoplodera variicornis* (Dalm.).

in anterior half forming two to three indistinct transverse rows. Clypeus short, broad, bulges slightly. Labrum large, bulges, smooth, rounded on anterior margin, fringed with long dense setae, and with one long seta on each side of disk. Mandibles elongate, obliquely notched apically, with produced lower apical denticle.

Pronotum transverse, 2.5 times wider than long, bulges slightly on disk, with stray setaceous hairs. Pronotal shield striate, coriaceous, without perceptible lateral longitudinal fold. Prosternum with sparse setaceous hairs; eusternum coriaceous, without sclerotized spinules, with stray



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Figure 168. Larva of *Anoplodera variicornis* (Dalm.).

a—head and pronotum; b—abdominal tergite with locomotory ampulla.

hairs on anterior margin. Thoracic legs developed, with acute subulate claws.

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Dorsal locomotory ampullae bulge moderately, transversely elongate; with four rows of granules, of which middle rows proximate, outer ones laterally fused, forming outer transverse elongate ellipse. Ventral locomotory ampullae with two rows of granules. Body white. Head rusty, black on anterior margin, mandibles black. Pronotum laterally and in anterior half rusty, transverse band on anterior margin with narrow whitish notches. Length of body 30 to 35 mm.

Pupa (Figure 169): Body massive. Head comparatively short, moderately bent under, gently rounded behind antennal base. Frons broad, raised around antennal bases and with long spinescent setae here, and five to six spinescent setae on anterior margin forming indistinct transverse row. Antennae flexed to sides, with apices curved ventrad. Pronotum narrows anteriorly, bulges on disk, with short spinules medially at base forming indistinct transverse row bent backward. Mesonotum bul-

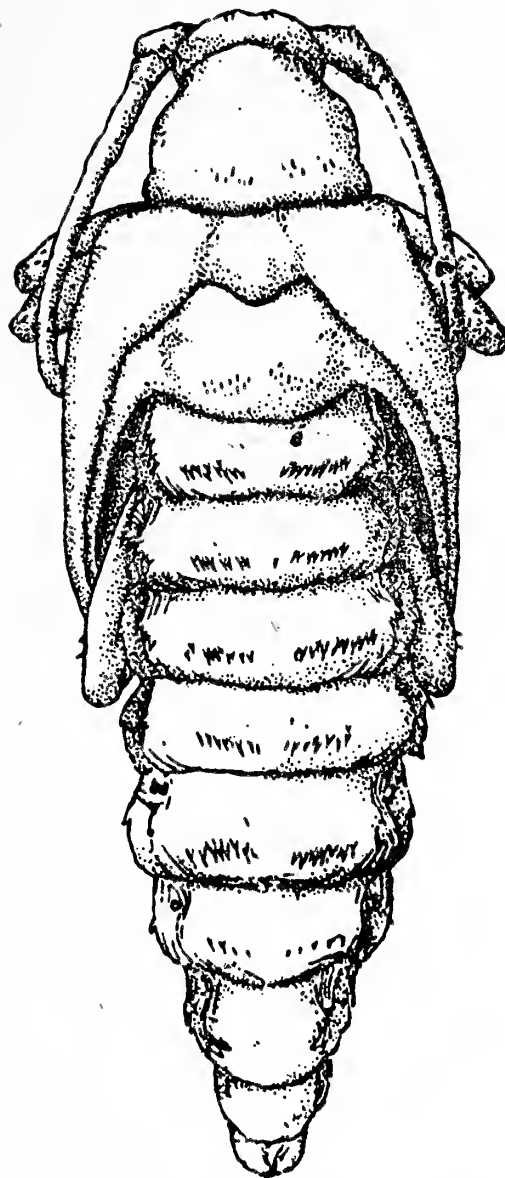


Figure 169. Pupa of *Anoplodera variicornis* (Dalm.).

ges at anterior margin, with a few minute spinules. Metanotum in posterior half with two tufts of short spinules.

Abdomen narrows posteriorly. Tergites in posterior half with sharp spinules set on produced tubercles forming dense transverse paramedial row, with two to four spinules in middle forming additional transverse row. Tip of abdomen obtuse (ventral view), bound by horseshoe-shaped carina bearing minute acicular spinules, and with pair of urogomphi dorsally. Valvifers of female well developed, hemispherical, somewhat
282 produced laterally at apex. Length of body 18 to 23 mm, width of abdomen 4.0 to 8.0 mm.

Material: Altai, Salair, Baikal region, Primor'e, and other regions of northern Asia. Adult insects over 1,500, larvae 114, pupae—nine males and eight females. Beetles raised on fir, birch, and other species, 101 specimens.

Distribution: Europe and northern Asia. In Siberia from the Urals to Pacific Ocean coast; northern Mongolia, northeast China, Korea, and Japan.

Biology: *A. variicornis* (Dalm.) inhabits coniferous and mixed forests. Ecologically associated with coniferous and deciduous wood species; population in Salair forests develops mainly on deciduous species, and population in mixed forests of Ussuri-Primor'e region mainly on conifers. Spreads in mountains up to a height of 2,000 m. Flight of beetles commences in second half of June and ends mid-August. In Altai a large number of beetles were caught after the vegetative period, of which 26 (2.9%) were found in June, 543 (60.9%) in July, and 322 (36.2%) in August. Beetles quite often feed on flowers of various plants. Female lays eggs in bark crevices. Fecundity high. Ovaries of one female dissected just after emerging from wood contained 279 eggs, of another 366 mature eggs. Embryonic development at 18°C took 16 to 20 days. In 1969 larvae hatched on August 25 from eggs laid on August 4th and 5th in gardens under a sloping forest.

Larvae initially live under bark, then bore into wood, make longitudinal galleries there, and plug them densely with frass. After second, possibly third hibernation, larva makes pupal cell up to 30 mm long and 8.0 mm wide. Pupation of larvae commences in last few days of May and ends in early July. Pupae maximum at end of June. Young beetles sighted from middle 10 days of June. Emerging beetles nibble round flight openings (6.0 to 8.0 mm in diameter) on trunk surface. Emergence of beetles from pupal cells commences in middle 10 days of June and ends in July. Weight of larvae before pupation 233.9 to 688.0 mg, pupae 203 to 583 mg, and adults 110 to 457 mg. Weight reduction during metamorphosis is exemplified by the following: A larva before pupation weighed 426 mg, pupa developing from it 375 mg, and adult (female) emerging from pupa 270 mg. One pupa weighed 448 mg and adult developing from it 377 mg. Another pupa weighed 230 mg and emerging adult 157 mg. Thus during the period of adult formation weight dropped by 21.2%.

A. variicornis (Dalm.) colonizes thick-trunked dead standing and wind-felled trees, as well as stumps. Larvae quite often live in rotten wood. I have raised beetles on linden, willow, birch, spruce, and Khingan fir. They usually avoid viable trees or even those in the process of decaying.

7. *Anoplodera rubra* (L.)

Linnaeus, 1758, *Syst. Nat.*, 10th ed., p. 397 (*Leptura*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 360–362 (*Leptura*); Gressit, 1951, *Longicorn Beetles of China*, vol. 2, p. 88.

Adult (Figure 170): Readily distinguished by sexual dimorphism, light-colored tibiae, serrate antennae, and other features. Body massive in female, elongate in male. Head with dense minute punctation, nar-

row median longitudinal suture, tubercular bulge around antennal bases with minute adherent hairs, and short suspended temples covered with dense long erect hairs. Antennae in female extend beyond 0.50, in male
283 beyond 0.75 length of elytra, serrate from 5th segment, with acute, more produced outer distal margin in male.

Pronotum slightly transverse (female) or not longer than width at base (male), narrows somewhat anteriorly, with smooth narrow flange on anterior margin, deep transverse groove at base, slightly bulging disk with dense minute punctation and minute light-colored adherent hairs; in female oblique dent present at posterior angles and sometimes nar-

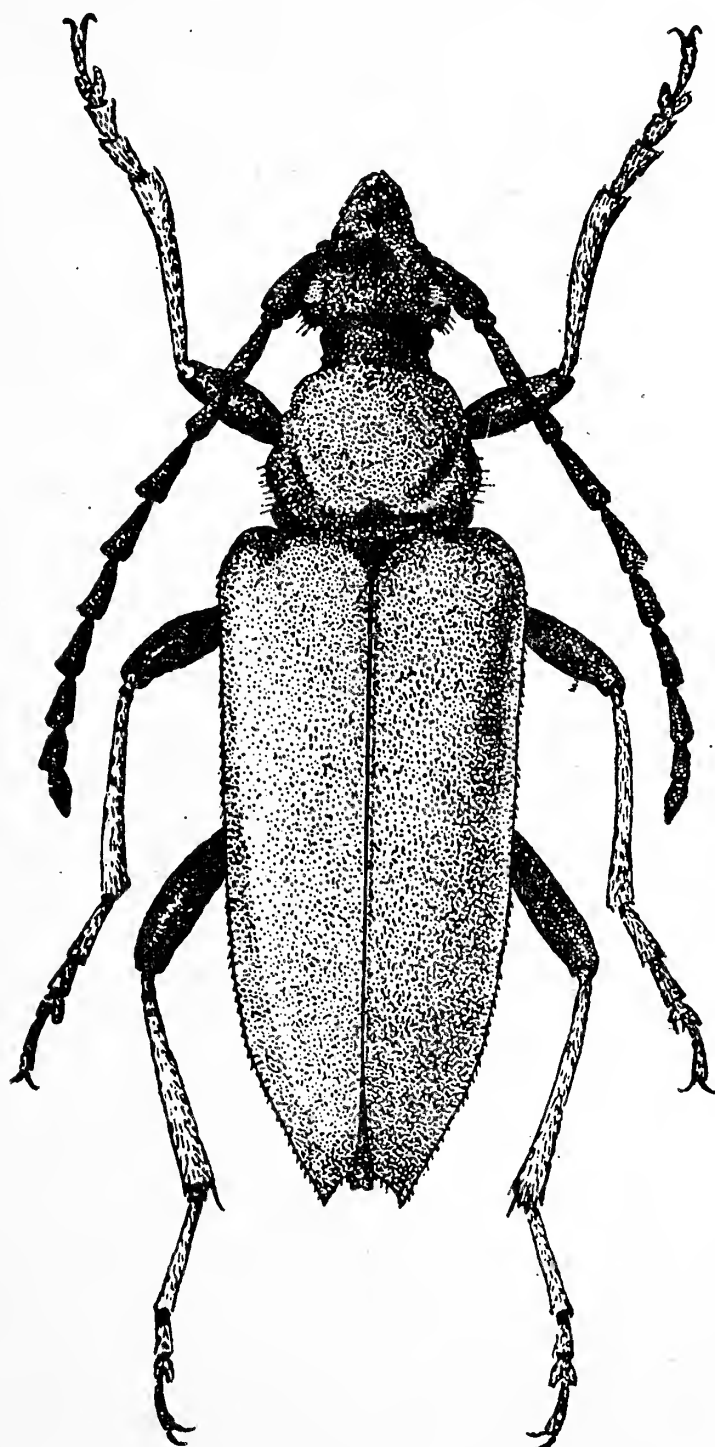


Figure 170. *Anoplodera rubra* (L.).

row smooth median longitudinal groove. Scutellum triangular, pointed posteriorly, with minute, barely perceptible adherent hairs.

Elytra convex, broad, narrow slightly posteriorly (female) or narrow, elongate, and narrow more posteriorly (male); obliquely notched apically, with acute produced outer angles; with minute punctation, and light-colored adherent hairs. Femora almost uniformly thick; hind tarsi long and slender, in male almost longer than tibiae. Abdominal tergite V posteriorly rounded (male) or deeply notched (female); sternite V posteriorly broadly and deeply notched (male) or obtuse (female). Body in female black; pronotum, sometimes spot on occiput and elytra red. All tibiae reddish-yellow. Body, including pronotum in male black, elytra and tibiae straw-yellow. Antennae, femora, and scutellum black. Body length of male 12 to 18 mm, of female 16 to 19 mm.

Egg: White with yellow tinge, elongate, narrows more toward one pole and narrowly rounded here, broadly rounded at the other; smooth, with perceptible cellular sculpture only at poles. Length 1.0 mm, width about 0.5 mm.

Larva (Figure 171): Characterized by two sclerotized spots on eusternum. Head broadly rounded in posterior half, gently narrows anteriorly, abruptly posteriorly, with short and long setaceous hairs laterally in anterior half, and single hyaline ocellus at antennal base. Epistoma almost flat on disk, in middle third and on anterior margin with long rusty hairs, laterally with distinct white frontal sutures, with sharp median longitudinal brownish suture smoothened in anterior third, almost imperceptible here. Hypostoma bulges notably, narrows somewhat anteriorly, with broad white median longitudinal band, and seven to eleven setaceous hairs laterally in anterior half. Clypeus broad, slightly narrows anteriorly, brownish basally. Labrum transverse, broadly rounded; with dense adherent setae on anterior margin, and long, slightly bent or almost straight setae laterally and on disk closer to base. Mandibles broad basally, markedly obliquely truncate anterodorsally, with lower denticle produced, rostriform, and long cultrate carinate projection on inner side extending from upper denticle, and outer side with matte transverse girdle.

Pronotum bulges insignificantly, with short widely separated setaceous hairs on disk, and sparse long thin hairs laterally. Pronotal shield bulges, faintly but still perceptibly striate, glabrous; with pair of widely separated setae only at base. Disk of meso- and metanota sclerotized. Prosternum in region of presternum and on anterior margin of eusternum with numerous setaceous hairs forming common transverse field. Eusternum bulges, with sclerotized transverse spot laterally closer to base, and rounded inner margin. Thoracic legs slender, with long hairs; anterior clivus between them sclerotized, with very minute spinules on each thoracic sternite forming transverse brownish band.

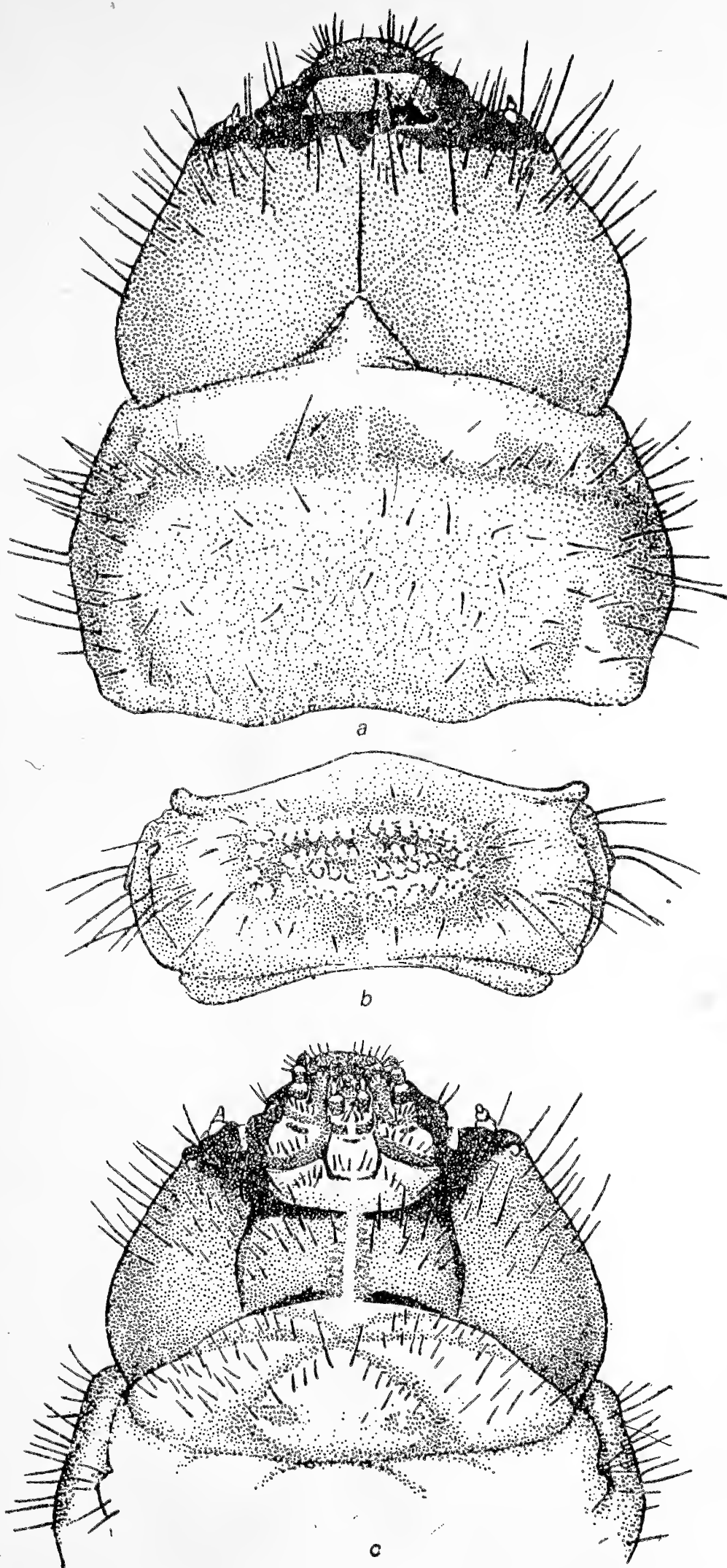


Figure 171. Larva of *Anoplodera rubra* (L.).

a—head and pronotum; b—abdominal tergite with locomotory ampulla;
c—head and prothorax (ventral view).

Abdomen elongate, with sparse hairs laterally. Dorsal locomotory ampullae bulge, with deep longitudinal groove; distinct bulging hyaline granules form two transverse ellipses; spaces between granules shagreen. Body white. Head rusty, brownish on anterior margin of epistoma. Sides and anterior margin of pronotum with transverse rusty-yellow band interrupted medially by narrow white clearance; two deep alveolar notches on anterior margin along each side. Length of body up to 30 mm, width of head up to 4.0 mm.

Pupa (Figure 172): Body large and stocky (female) or elongate and not very large (male). Head comparatively short, with broad longitudi-

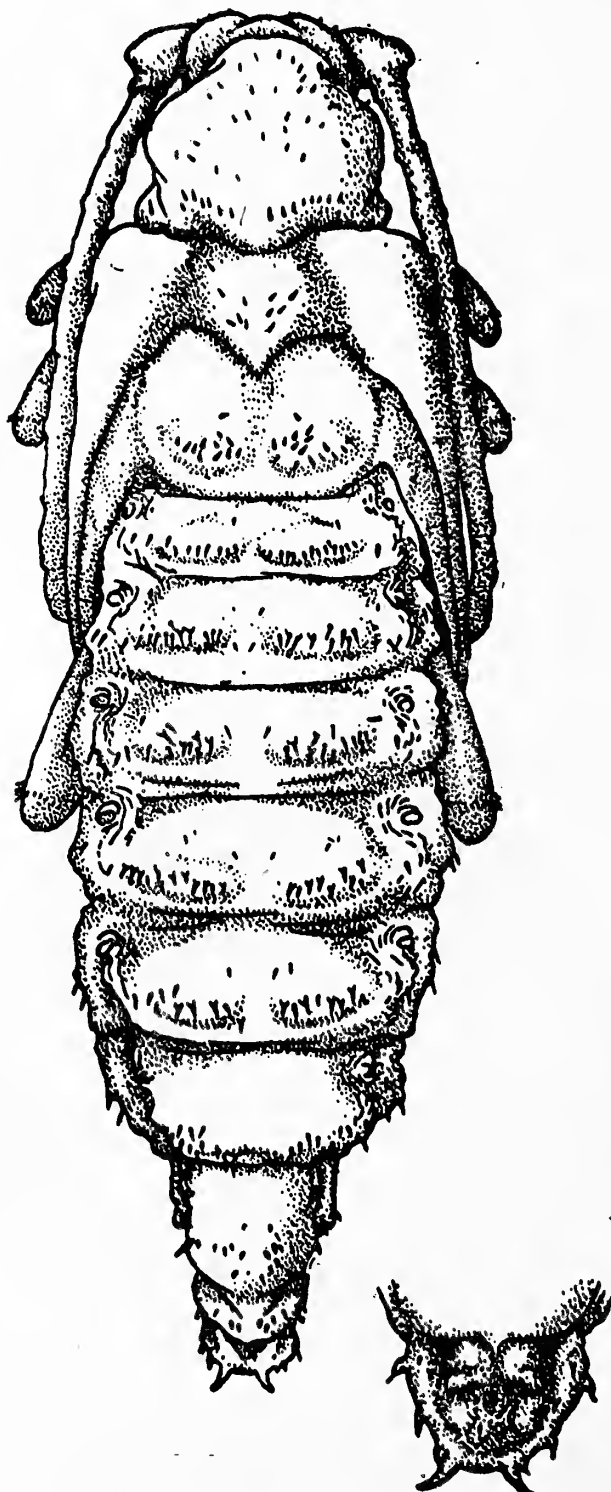


Figure 172. Pupa of *Anoplodera rubra* (L.).

nal groove between antennae, with one (female) or two (male) lateral spinules along occipital tubercles, usually with three spinules at antennal bases, and six spinules forming transverse row bent backward on anterior margin. Antennae arcuate.

Pronotum bulges insignificantly on disk, with faint median longitudinal groove, at anterior margin with more or less perceptible flange or without it, at posterior angles on inner side with deep or faint oblique dent; at base with acute setaceous spinules forming transverse row interrupted medially, and short diffuse acicular spinules or setae on disk and in anterior half. Mesonotum with group of minute spinules forming more or less distinct oblique paramedial band; metanotum in posterior half with minute spinules forming transverse band interrupted medially.

Abdomen narrows posteriorly from segment V, abdominal tergites I to VI convex, with median longitudinal groove, and short subulate paramedial spinules in posterior half set on papilliform base forming transverse row. Tip of abdomen (ventral view) obtuse, more impressed in female, produced into lateral carina with fairly large spinules that sometimes are biapical. Urogomphi comparatively large, with one or two apical spinules. Body length of male and female 15 to 22 mm.

Material: From Altai, Tuva, and Ob' region. Adult insects over 600, of which 72 raised in the laboratory, larvae 168, pupae—five males and seven females.

Distribution: From Atlantic Ocean coast to Baikal, from Tuva, Altai to Khanty-Mansiisk and Yenisey. Numerous in foothills of Altai, Salair, and Ob' region (Novosibirsk and Tomsk); rarely seen in the Sayans.

Biology: Inhabits coniferous, mainly pine forests. Flight commences in June and continues up to September. Beetles maximum in July and August. Thus during systematic collection of 582 beetles in various regions, 2.2% were found in June, 50.7%—July, 46.7%—August, and 0.4%—early September. In the foothills of Altai en masse flight is shifted to the second half of July and in August. Beetles feed quite often on flowers, mate, then oviposit in bark crevices. Fecundity comparatively high. Ovaries of one virgin female dissected 16 days after emerging from wood contained 250 mature eggs, while another contained 449 mature eggs. In nature embryonic development from the time of oviposition to hatching of larva continues for two to four weeks, average 22.2 ± 0.1 days. In Salair forests in 1969 en masse hatching of larvae was observed end of August and terminated mid-September. Thus of 579 larvae kept under observation, 0.2% had hatched by August 15, 6.0%—August 16 to 20, 12.9%—August 21 to 25, 65.4%—August 26 to 31, 15.2%—September 1st to 5th, and 0.3%—September 6th to

19th. Under laboratory conditions, at 10.8 to 21.4°C ($17.1 \pm 0.4^\circ\text{C}$), embryonic development took 17 to 28 days, average 21 ± 0.3 days. In nature, at 10.5 to 28.9°C, larvae hatched after 15 to 31 days, average 22.2 ± 0.1 days.

On hatching larvae bore into bark, make longitudinal galleries underneath it, then penetrate deeper into wood, live in its upper layer to a depth of 3.0 to 5.0 cm, and plug galleries with frass. Pupal cell made at end of gallery along trunk, in which larva pupates. Length of cell up to 30 mm, width up to 13 mm.

Table 10. Weight variation in *Anoplodera rubra* (L.) during metamorphosis (mg)

Sex	No. of insects	Larvae before pupation	Pupae	Adult insects
Male	9	185.9 (70.5–390.5)	169.5 (65.5–355.0)	120.3 (50.5–325.0)
Female	6	538.5 (430–660)	448.1 (382–600)	364.8 (258–451)

Note: Average values, range in parentheses.

Pupation commences in first half of June and ends in early July. Pupae maximum in nature from end of June to early July. Pupae develop in three to four weeks. First beetles sighted in second half of June. 287 Emergence of beetles from wood ceases end of July. Weight indexes reflect sexual dimorphism of this species to a significant degree (Table 10). In all developmental stages the female is about 3.0 times larger than the male.

Beetles develop in stumps, dead fallen trees, and trunks of dead conifers (*Pinus sylvestris*, *P. sibirica*, and others). Often colonize thick-trunked dead fallen pine in which upper layer of wood has been attacked by fungus. *Anoplodera virens* (L.), *Tragosoma depsarium* (L.), *Arhopalus rusticus* (L.), and others live together with this species (especially on stumps).

8. *Anoplodera succedanea* (Lew.)

Lew's, 1873, *Ann. Mag. Nat. Hist.*, vol. 4, p. 464 (*Leptura*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 362–363 (*Leptura*).

Adult (Figure 173): Differs from the closely related species *Leptura rubra* (L.) in red elytra and red pronotum in male, and very narrow steep apical incision of elytra. Body large and elongate. Median longitudinal suture of head distinctly raised in region of frons; with minute semiadherent hairs, dense (very large on occiput) punctation, and short suspended, densely pubescent temples. Antennae short, extend beyond middle of elytra (female) or notably longer and reach last quarter, and slightly (female) or markedly (male) serrate from 5th segment.

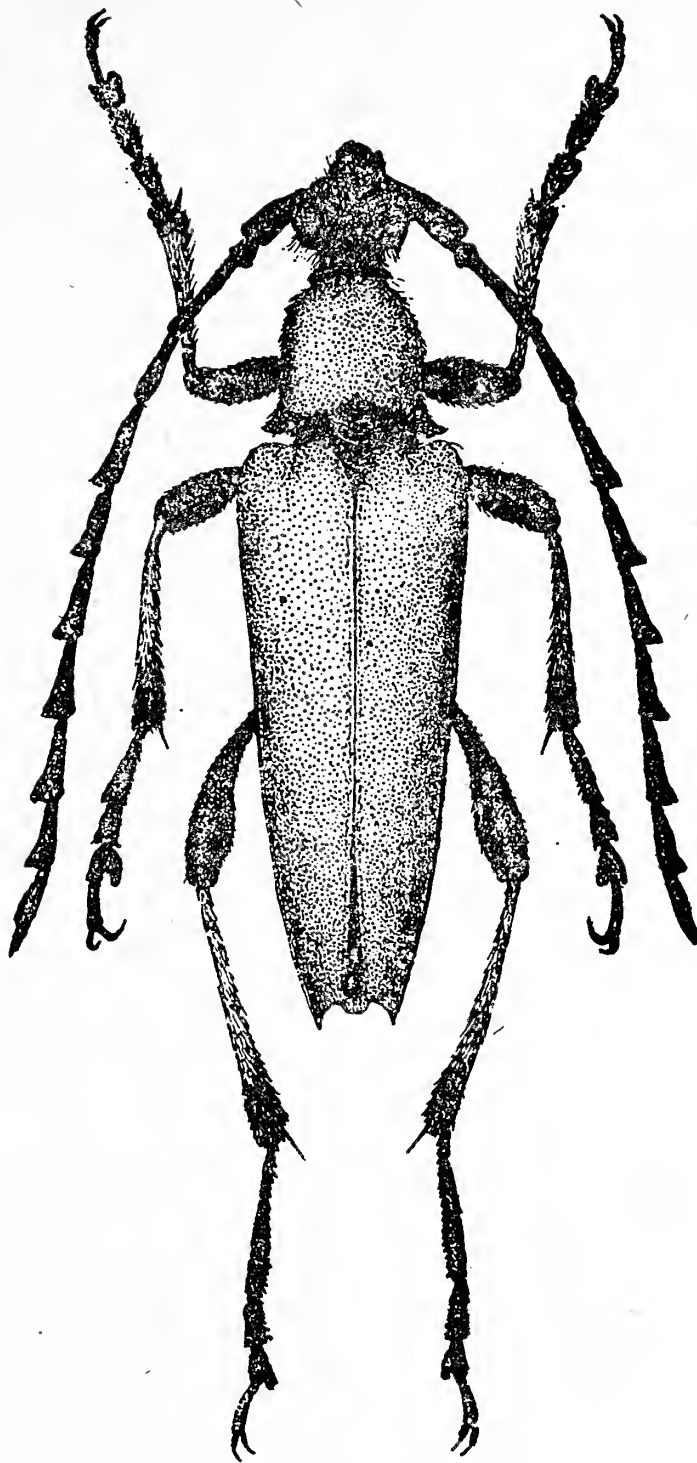


Figure 173. *Anoplodera succedanea* (Lew.).

Pronotum somewhat longer than width at base, markedly narrows anteriorly, with narrow flange on anterior margin, and deep transverse groove at base; with dense round punctation, minute adherent hairs, sometimes with smooth longitudinal band in middle of posterior half; bulges on disk, sometimes with smooth oblique lateral dents on posterior angles. Scutellum somewhat elongate, pointed posteriorly, black.

Elytra elongate, convex, gradually (female) or markedly (male) narrow behind humeri, steeply incised apically, with highly produced outer angles, minute punctation, more noticeable at base, and minute semi-adherent yellowish hairs. Hind tarsi considerably longer than tibiae.

Head, antennae, underside of body, and femora black. Pronotum red, often black along anterior margin and at base. Elytra in both male and female red. Tibiae mainly red, blackened apically, sometimes hind tibiae uniformly black, tarsi black. Length of body 12 to 21 mm.

288 *Egg*: White, pointed at one pole, broadly rounded at the other, with distinct flat cellular sculpture; cells five- or six-faceted, with very narrow spaces between them. Length 1.8 mm, width about 0.5 mm.

Larva (Figure 174): Differs from larva of *Anoplodera rubra* (L.) in distinctly convex hypostoma, broadly impressed epistoma, and other features. Body of mature larva large. Head bent downward, slightly retracted into pronotum, broadens roundly behind middle, and broadly impressed in epistomal region (posterior half); with long sparse lateral hairs in anterior third, bulging hyaline ocellus, and transversely elongate marginal prominence between it and antenna. Epistoma with less distinct frontal sutures, impressed in posterior half, with brownish median longitudinal suture disappearing in anterior third, and long and short reddish hairs in anterior half. Hypostoma bulges tubercularly in middle, narrows slightly anteriorly, with white longitudinal gula, and seven to eight setaceous hairs laterally. Clypeus trapezoidal, bulges, white with brownish base. Labrum red, bulges, with long setae on anterior margin, and glabrous disk except for one long seta closer to posterior angles.

Pronotum transverse, broadens somewhat anteriorly, with very long hairs laterally, sometimes forming transverse row on anterior margin,

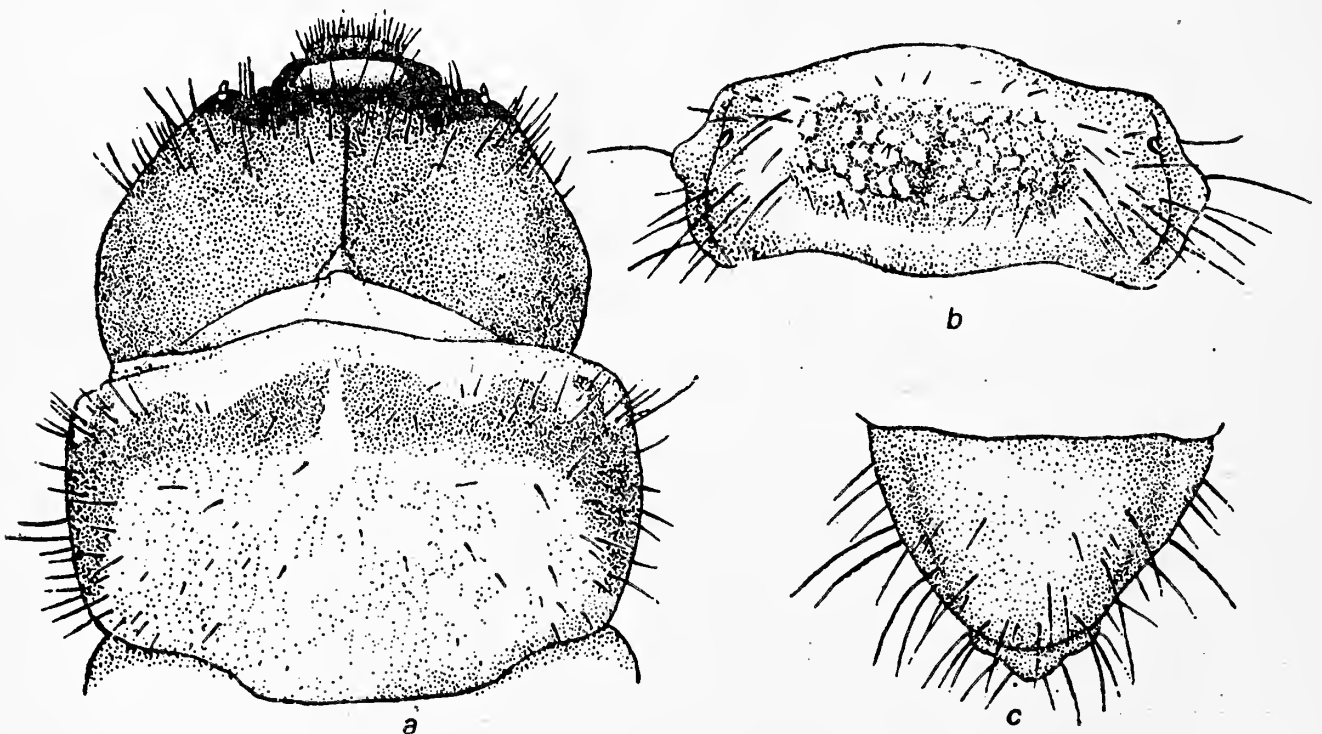


Figure 174. Larvae of *Anoplodera succedanea* (Lew.).

a—head and pronotum; b—abdominal tergite with locomotory ampulla;
c—tip of abdomen.

and short setaceous hairs in anterior half on disk. Pronotal shield bulges notably, striate, laterally with indistinct longitudinal dents, and pair of widely separated setaceous hairs at base. Prosternum with long setaceous hairs. Eusternum with sclerotized transverse, sometimes faint spot posterolaterally.

Abdominal tergites with long hairs laterally and short hairs on anterior and posterior margins around locomotory ampullae. Dorsal locomotory ampullae with hyaline granules forming two distinct transversely elongate ellipses—one outer and one inner, with four to six setae between rows of inner ellipse. Body white. Head reddish-rust, labrum red. Sides and anterior third of pronotum with rusty-yellow transverse band produced forward in middle of its anterior margin. Length of body up to 34 mm, width of head about 5.0 mm.

Pupa (Figure 175): Readily distinguished from *Anoplodera rubra* (L.) in structure of spinules at tip of abdomen. Body elongate. Head moderately bent under, with transverse broad dent behind antennae,

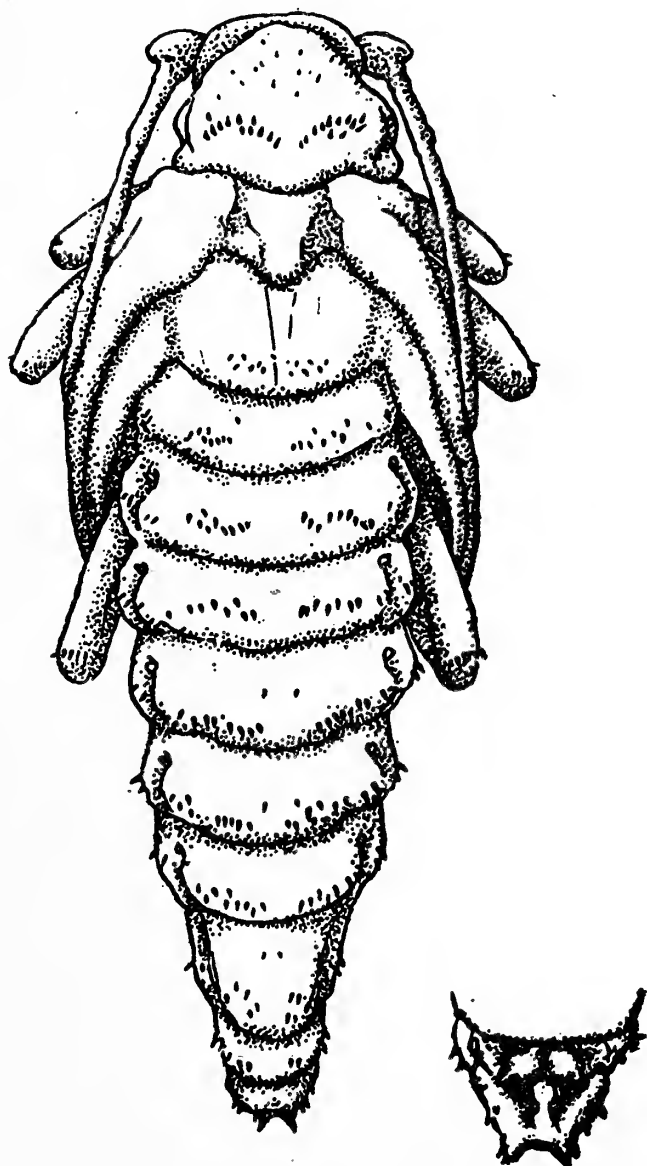


Figure 175. Pupa of *Anoplodera succedanea* (Lew.), female.

three to four spinules on occipital tubercles, and usually four short acute spinules at base of antennae on inner side. Antennae arcuate (female) or almost annular (male).

Pronotum convex, barely narrows anteriorly, with longitudinal groove in middle of hind clivus, minute diffuse spinules in anterior half, very large spinules at base forming transverse row or narrow transverse band broadly interrupted medially, and steep and rounded at base. Mesonotum with faint stray spinules. Metanotum with minute spinules forming transverse band interrupted medially, or two tufts separated by longitudinal groove.

Abdomen barely elongate anteriorly, narrows more posteriorly from tergite V. Abdominal tergites with broad median longitudinal groove, acute subulate spinules behind middle on protuberant coriaceous base forming broad transverse band interrupted medially; band consists of one, two, or three indistinct rows. Urogomphi at tip of abdomen well developed, terminate in acute sclerotized spinule, and curve dorsolaterally. Tip of abdomen obtuse ventrally, with markedly produced lateral carinae set with minute spinules. Valvifers of female bend apically toward each other, with large bulging tubercle laterally close to apex. Length of body 20 to 24 mm, width of abdomen 4.0 to 5.0 mm.

Material: Collected in Ussuri-Primor'e region, Kunashir, and Sakhalin. Adult insects 63, larvae 90, pupae—eight males and five females.

Distribution: Trans-Baikal, from Yablonov range to Primor'e inclusive, Kunashir and Sakhalin; Japan, Korea, northern China. Very abundant in Kunashir in Mendeleevo region, Sernovodsk and Alekhino.

Biology: Inhabits coniferous forests, often Siberian stone pine shrubs. Flight of beetles commences in July and ends early September. En masse flight end of July and first half of August. Beetles survive for three to four weeks. Eggs laid in bark crevices of felled and standing dead conifers (*Pinus koraiensis*, *P. pimula*, *Picea* sp., and others). Eggs laid quite often in bark of stumps. Fecundity comparatively high. On
290 dissection of two virgin females 271 eggs were found in the ovaries of one and 215 in the other. Embryonic development from time of oviposition to hatching of larvae continues for about three weeks. Thus from eggs laid July 30 through August 6th, larvae began hatching from August 21. Similar observations have been recorded on various occasions.

Hatching of larvae ceases in September. Larvae initially make longitudinal galleries under bark, then in wood, plug them with frass; width of gallery up to 10 to 16 mm. Mature larva makes pupal cell at end of gallery along trunk in upper layer of wood and pupates in it. Sometimes exit made from cell to trunk surface, then plugged with fibrous frass. Length of cell 3.5 to 5.0 cm, width 1.0 to 1.4 cm.

Pupal stage continues for 16 to 18 days. Young beetles sighted from June through August. Remain in pupal cells up to one week. Emerge from cells with developed gonads, mate soon after emergence from wood, and subsequently oviposit. Weight of larvae before pupation 300 to 560 mg, pupae 170 to 416 mg, and adult insects 102.5 to 359.0 mg. Weight of one insect (male) as larva before pupation 278 mg, pupa 250 mg, and adult 158 mg.

9. *Anoplodera scotodes* (Bat.)

Bates, 1973, *Ann. Mag. Nat. Hist.*, 12, 4, 194 (*Leptura*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 369-372 (*Leptura*).

Adult (Figure 176): Easily recognized by markedly bulging, densely punctate, matte pronotum and matte, coarsely punctate elytra. Head

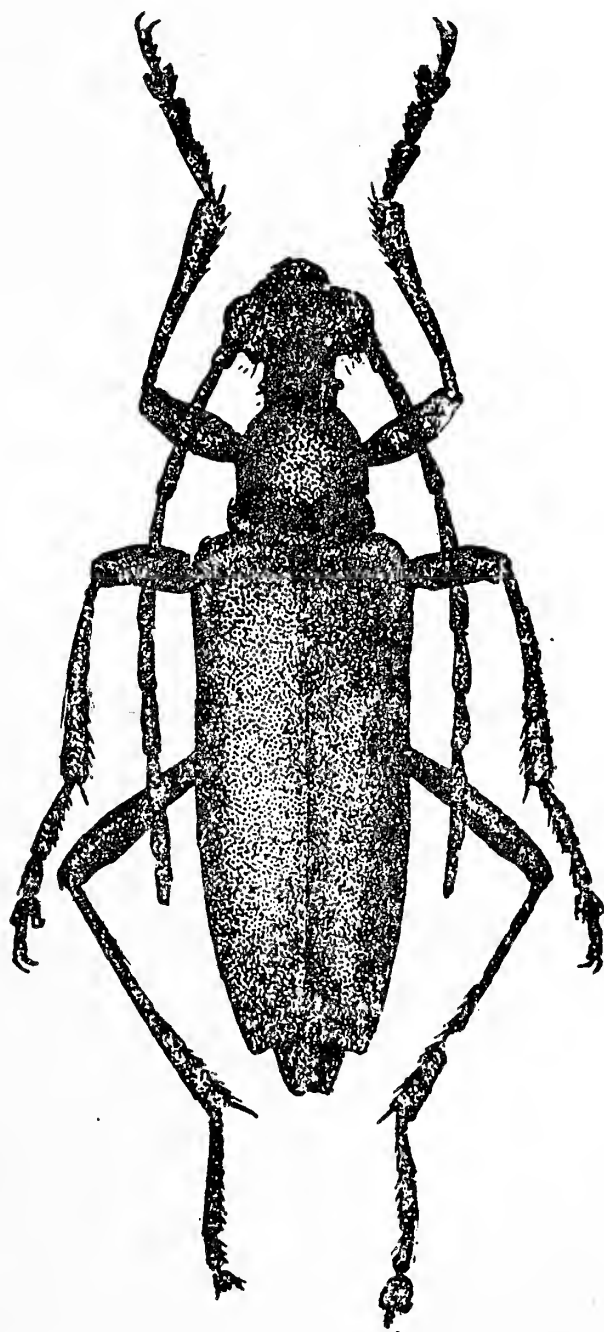


Figure 176. *Anoplodera scotodes* (Bat.), female.

matte, sometimes sparsely pubescent, with dense uniform, rather small, flat punctation. Cervical region with dense punctation; temples upright, sometimes with dense long erect hairs. Antennae extend beyond 0.50 (female) or 0.75 (male) length of elytra, sometimes almost reaching elytral apices; 3rd antennal segment equal to 5th, longer than 4th.

Pronotum matte, bulges spherically on disk, narrows in anterior third, with deep narrow flange on anterior margin, transverse groove at base; with uniform dense flat punctation, and spaces between them half size of punctures per se. Scutellum elongate, markedly narrows anteriorly and narrowly rounded here, with adherent, sometimes dense hairs.

Elytra matte, convex, narrow more (male) or less (female) from humeri to apex, straightly truncate apically, with rounded or obtuse outer and invariably obtuse inner angle, with dense large punctation. Hind femora in male reach apex of elytra, considerably shorter in female. Abdominal sternite V in male notably impressed longitudinally on anterior margin, sometimes slightly emarginate (ssp. *continentalis* Plav.). Head, pronotum, and elytra almost glabrous, with sparse hairs perceptible only under high magnification. Frons sometimes with dense erect hairs. Body black. Elytra black (ab. *masculina* Plav.), or red (ab. *nipponensis* Pic), or black with red border basally that is sometimes produced posteriorly, and encompasses humeral tubercles. Length of body 8.0 to 12.5 mm.

Egg: White, elongate, broadly rounded at poles, with dense cellular sculpture. Cells large, five- or six-faceted, with spaces between them in form of thin lines. Length 1.5 mm, width 0.4 mm.

Larva (Figure 177): Differs from other species of this genus in large rounded head and poorly (stray) pubescent pronotum. Head appears rounded anterolaterally, slightly bent ventrally, with numerous short lateral hairs in anterior half. Epistoma whitish, markedly narrows posteriorly, appears acutely produced apically, with long thin hairs in anterior half. Frontal sutures faint, sometimes slightly curved apically. Median longitudinal suture distinctly visible throughout its length, only insignificantly smoothened at anterior margin. Hypostoma distinctly bulges medially in region of white gular band, with straight, sometimes slightly curved sutures laterally, and with 10 to 13 setaceous hairs on each side of white band.

Pronotum broadens anteriorly, gently rounded at posterior margin; with tender hairs laterally, visible only under high magnification, and short setaceous sparse hairs on disk in anterior half. Pronotal shield bulges, white, striate, with distinct lateral longitudinal folds basally. Prosternum with uniformly spaced hairs. Eusternum coriaceous, without perceptible sclerotization.

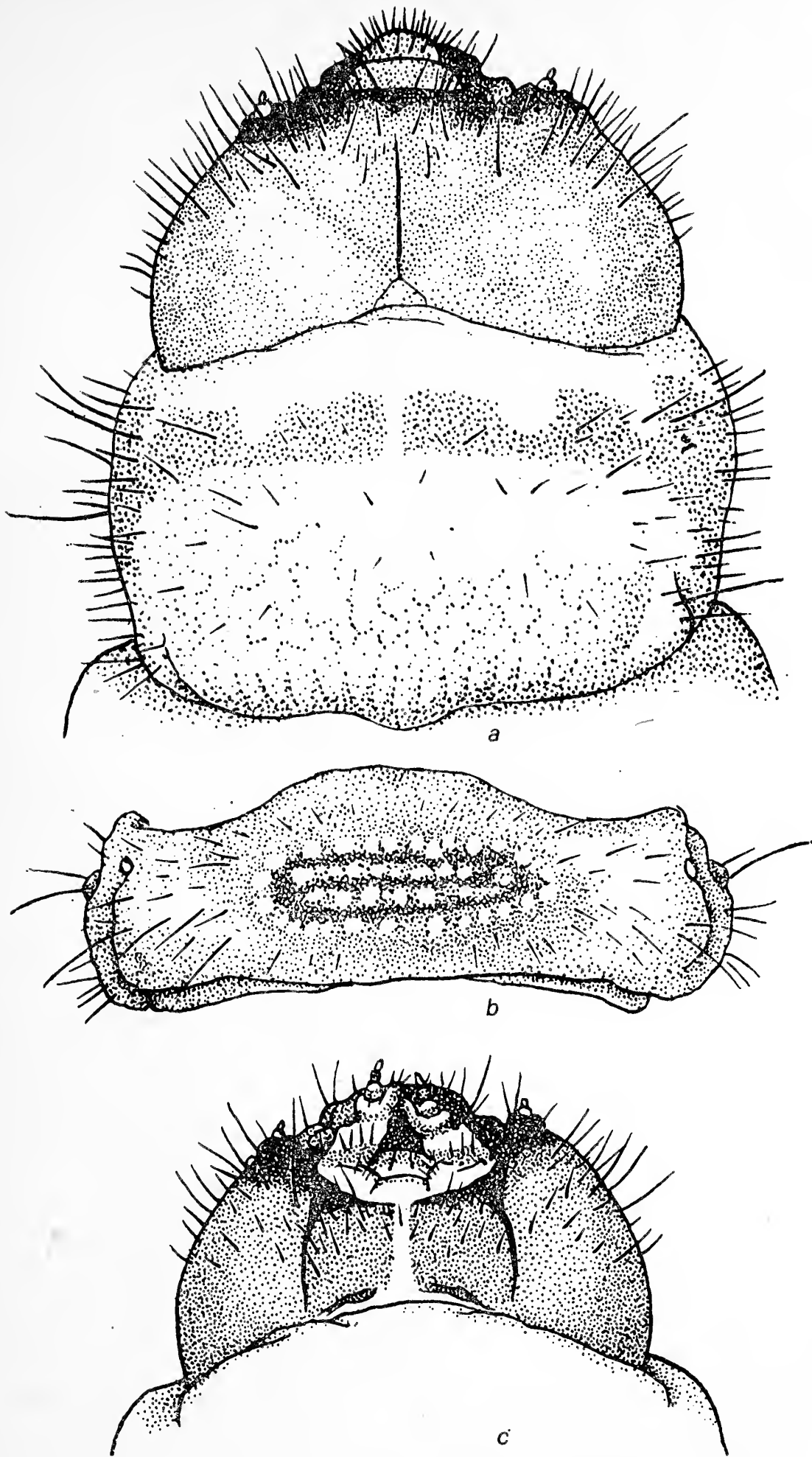


Figure 177. Larva of *Anoplodera scotodes* (Bat.).
 a—head and pronotum; b—abdominal tergite with locomotory ampulla;
 c—head (ventral view).

Abdominal tergites with minute, indistinct lateral hairs. Dorsal locomotory ampullae with granules forming two transverse markedly elongate ellipses; rows of inner ellipse markedly contiguous. Body white. Head rusty-yellow, black, or blackish-brown on anterior margin of epistoma; epistoma whitish. Sides and disk of pronotum in anterior third with transverse yellowish band interrupted medially by white longitudinal clearance in which three deep alveolar paramedial notches occur along anterior margin. Length of body 18 to 20 mm, width of head 2.8 mm.

Pupa (Figure 178): Body moderately elongate, head behind antennae rounded, without transverse dent, with tuft of spines on occipital tubercles. Antennae bent, annular.

Pronotum bulges spherically, narrows anteriorly, with spinules on anterior raised margin, narrow flange behind it, tuft of short spinules on disk, and acute spinules on base forming two bands diverging from middle laterally and slightly anteriorly. Mesonotum bulges, with a few short setae. Metanotum with short paramedial spinules forming tuft on posterior margin.

Abdominal tergites bulge; spinules on posterior margin set on protuberant base and form indistinct transverse row or band broadly interrupted medially. Tip of abdomen obtuse, with individual dissimilar lateral spinules set on protuberant coriaceous base. Urogomphi diverge, with acute brownish spinules. Valvifers of female large, hemispherical, with lateral tubercle apically. Length of body 9.0 to 14.0 mm, width of abdomen 3.8 mm.

Material: From Ussuri-Primor'e, Sakhalin, and Kunashir. Adult insects 49, larvae 28, pupae—six females and four males.

292 *Distribution*: Ussuri-Primor'e region, Sakhalin, Kunashir; northeast China, North Korea, Japan. Often found in Kunashir in Servovodsk and Alekhino region.

293 *Biology*: Inhabits coniferous forests. Beetles sighted in June up to mid-August, maximum from mid-June to mid-July. Feed on flowers of Umbelliferae, Rosaceae, and other plants, and mate on them. Female then flies to a tree and lays eggs in bark crevices. Colonizes thin shoots of 2.0 to 5.0 cm in diameter and small trunks of dead undergrowth of fir, maple, spruce, and juniper. Larvae hatch from eggs two weeks after oviposition. From eggs laid on June 17 to 27, larvae hatched on July 6th, and from eggs laid on June 27, larvae hatched on July 9th.

Larvae bore into bark, then into wood, and make longitudinal meandering, sometimes merging galleries, and plug them with frass. Often found on small trunks of dead undergrowth, usually colonize underside of root zone in upper layer of wood damaged by fungi. Sometimes larvae damage this layer almost totally. Before pupation larva makes

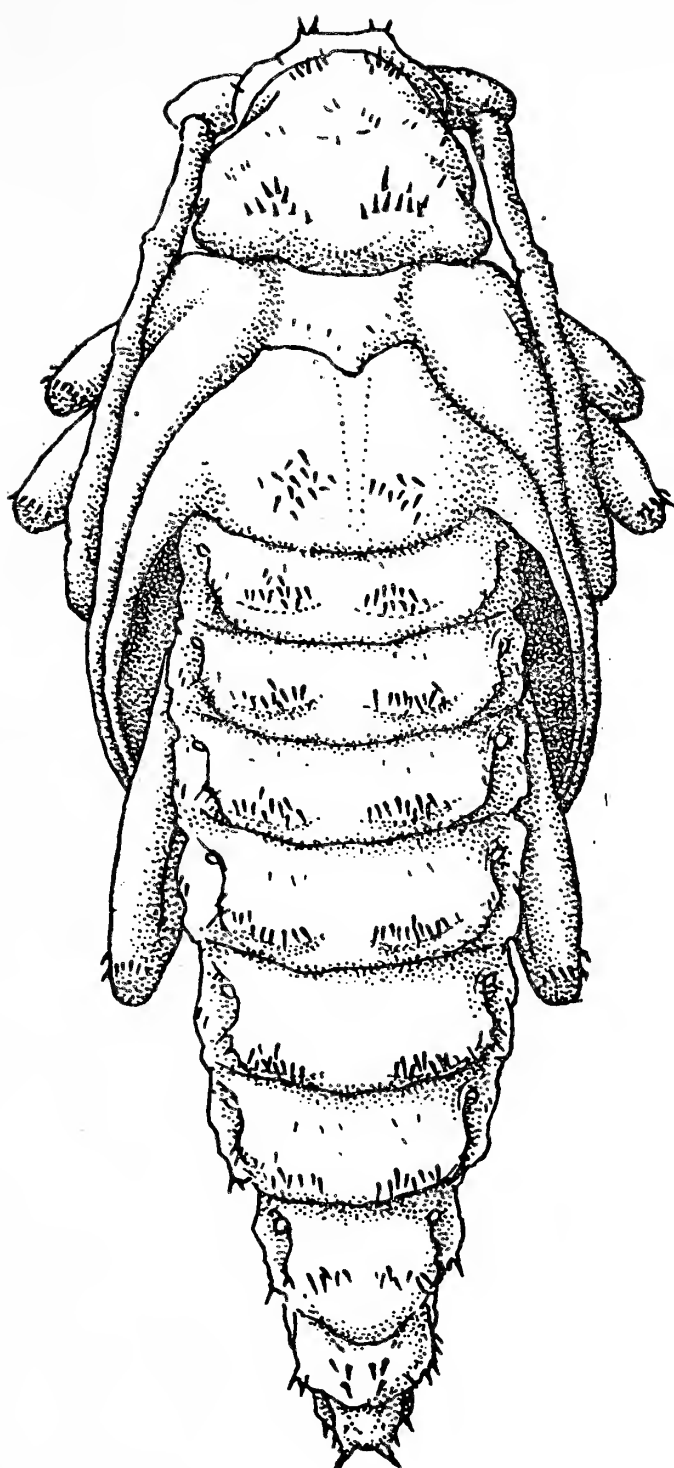


Figure 178. Pupa of *Anoplodera scotodes* (Bat.).

pupal cell in upper layer of wood along trunk surface or oblique to it. Length of cell 16 to 20 mm, width up to 4.0 mm.

Pupation commences in second half of May and ends in June. Beetles emerge from pupae in June and July. Developing beetles nibble round openings 2.8 to 3.5 mm in diameter on surface of shoots (small trunks) and emerge through them. Ovaries of one female on emerging from wood contained 48 mature eggs. Population density comparatively high. For example, in one small trunk 5.0 cm in diameter and 1.53 m long, 10 insects were found: five beetles, two pupae, and three larvae.

Weight of larvae before pupation 31 to 99 mg, pupae 29 to 86 mg, and beetles 21.5 to 59.0 mg. Female only marginally larger than male.

10. *Anoplodera sanguinolenta* (L.)

Linnaeus, 1761, *Fauna Suec.*, 2nd ed., p. 196 (*Leptura*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 372-373 (*Leptura*); Gressitt, 1951, *Longicorn Beetles of China*, vol. 2, p. 89.

Adult: Differs from other species in outer angles at apex of elytra markedly produced, spinescent, sharp sexual dimorphism, and other features. Head with dense deep punctation, almost flat between upper lobes of eyes, slopes slightly posteriorly, with insignificant prominences at base of antennae on inner side. Antennal apices reach beyond 0.50 (female) or 0.66 (male) length of elytra; 5th antennal segment slightly projects (rounded) apically; 3rd slightly longer than 5th; and 4th equal to 6th but 0.66 length of 3rd.

Pronotum elongate, markedly narrows anteriorly, roundly bulges on disk, with uniform dense round punctation. Narrow flange on anterior margin, deep transverse groove at base with almost straight sides, with slightly produced (female) or rounded (male) posterior angles, semi-adherent short hairs not forming compact cover, and long, thin, light-colored erect hairs laterally. Scutellum elongate, triangular, black, with tender light-colored hairs.

Elytra bulge, comparatively broad (female) or narrow and more elongate (male), narrow posteriorly, obliquely notched apically, with outer angle markedly produced, spinescent, and inner angle less produced sometimes slightly rounded; with dense punctation and short, semi-adherent, black setaceous hairs. Hind tarsi long, not shorter than tibiae with 1st segment considerably longer than remainder. Body ventrally with tender, silky, light-colored adherent hairs. Body and antennae black. Elytra in male straw-yellow with blackened apex, entirely red in female. Length of body 8.0 to 11.5 mm.

Material: Several beetles from the European part of the USSR (male and female) (collections of the Zoological Museum, Moscow State University and the Zoological Institute, USSR Academy of Sciences). Reported from Siberia by N.N. Plavil'shchikov (1936) and other authors, but I did not find it there.

Distribution: Europe, from Atlantic Ocean to the Urals. Widespread in Siberia, perhaps up to Baikal.

Biology: Flight of beetles commences in June and continues up to August inclusive.

11. *Anoplodera sequensi* (Reitt.)

Reitter, 1898, *Wien. Entom. Z.*, vol. 17, p. 194 (*Leptura*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 378-379 (*Leptura*).

Adult (Figure 179): Characterized by highly variable color of elytra, more elongate, densely punctate pronotum, and narrower temples. Head flat on vertex, with slightly raised tubercles at antennal bases, short

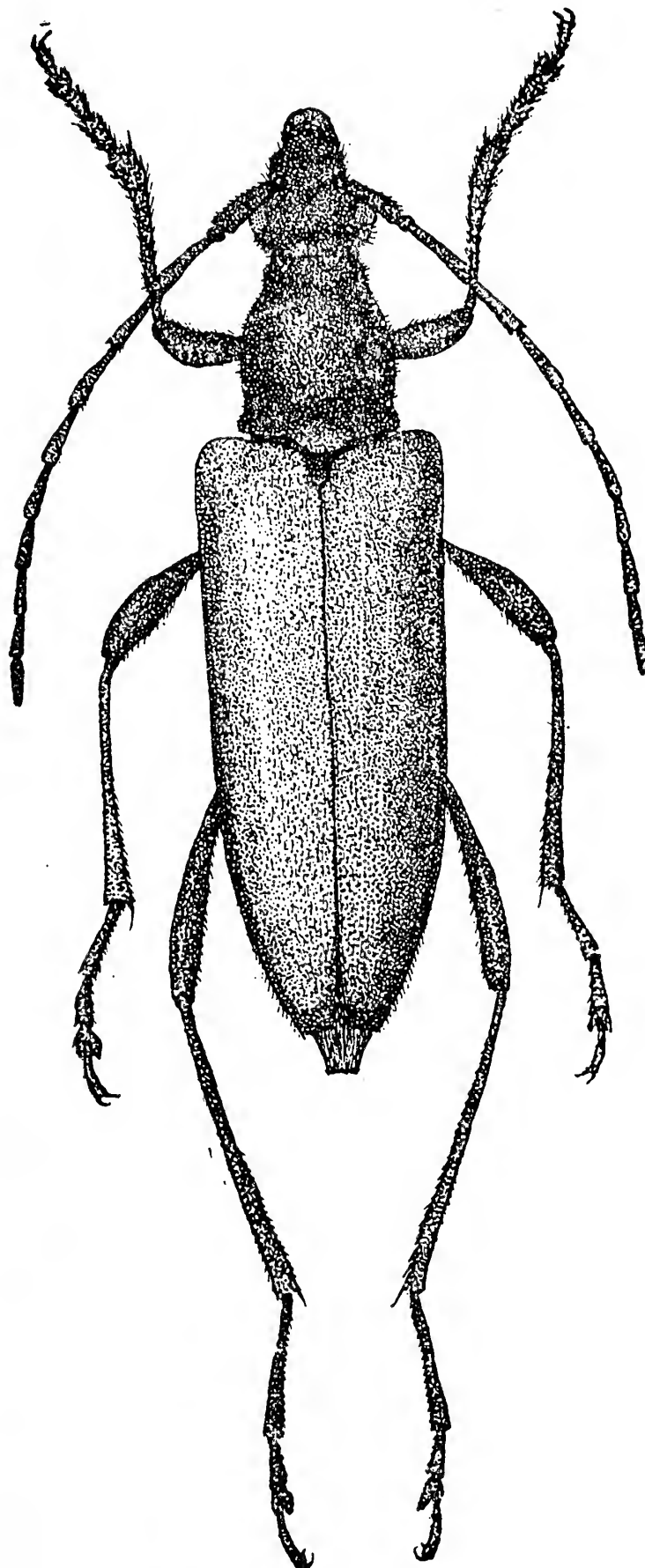


Figure 179. *Anoplodera sequensi* (Reitt.).

densely pubescent temples, perceptible dense, but not very distinct, alveolate cervix, and with dense punctation. Antennae from 5th segment slightly serrate, matte, with apices extending beyond middle (female) or almost up to hind clivus (male) of elytra.

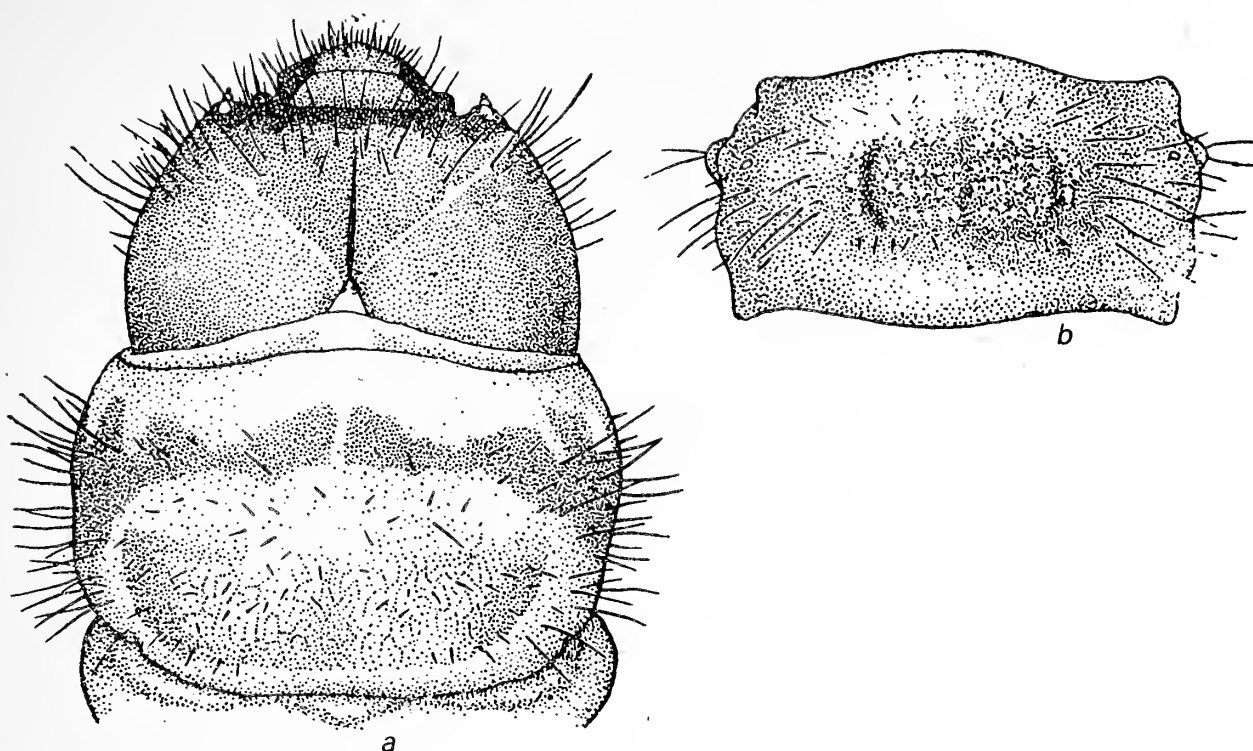
Pronotum elongate, narrows more anteriorly, slightly posteriorly, rounded laterally, with narrow flange on anterior margin, insignificant transverse groove at base, uniformly bulging disk, dense round punctures (spaces between them smaller than punctures per se), without flange posteriorly, oblique, sometimes longitudinal smooth band medially on hind clivus, and with adherent (erect only laterally) light-colored hairs.

Elytra with parallel sides (female) or markedly narrow basally (male), obliquely notched apically, with more produced acute outer angle, comparatively bulging disk, with minute punctation and short adherent hairs. Legs comparatively long; hind femora reach or almost reach elytral apices. Hind tarsi slender, with 1st segment usually longer than two successive together. Body, antennae, and legs black. Elytra straw- or brownish-yellow, with black border laterally, and suture blackened apically (f. *typica*); sometimes elytra brownish-red with matte tone and black border laterally (m. *rufopaca* Reitt.); rarely elytra black with reddish spots on base and anterior to apex (ab. *pulchrina* Reitt.), or with spot only at base (ab. *diversenotata* Pic), or with spot only on hind clivus (ab. *baicalensis* Pic); quite often elytra entirely black (ab. *tristina* Reitt.). However, these aberrations (Plavil'shchikov, 1936) represent transient forms from entirely light straw-yellow, brownish-red, to entirely black. Length 9.0 to 13.5 mm.

Egg: White, gradually narrows toward one pole, rounded at both poles, with large cellular (gridlike) sculpture. Cells flat, five- or six-faceted; spaces between them narrow. Length 1.8 mm, width 0.5 mm.

Larva (Figure 180): Characterized by large number of setae on hypostoma and absence of perceptible sclerotization on eusternum. Parietals broadly rounded, head slightly retracted into prothorax. Epistoma elongate, triangular, pointed posteriorly, bound laterally by straight well-developed frontal sutures, dark brown (almost black) smooth border on anterior margin, and long setaceous hairs forming two transverse rows medially and in posterior half. Hypostoma bulges transversely, slightly rounded laterally, slightly narrows anteriorly, with white longitudinal band medially and numerous setae (16 to 18 on each side of white band). Clypeus lustrous, white, brownish basally, markedly narrows anteriorly. Labrum rounded, bulges on disk, glabrous, with short brownish-rust setae along margins and at base.

Pronotum slightly less in length than width, bulges on disk, with sparse setaceous hairs laterally and in middle third (before shield), and rusty transverse band on anterior margin. Pronotal shield bulges,



296 Figure 180. Larva of *Anoplodera sequensi* (Reitt.).
a—head and pronotum; b—abdominal tergite with locomotory ampulla.

glabrous, coriaceous, and striate. Eusternum not sclerotized, coriaceous, lustrous, without striation, and with eight to nine long setaceous hairs apically. Meso- and metanota sclerotized in anterior half, with minute spinules forming matte rusty transverse band, and short setaceous hairs forming indistinct transverse row behind this band.

Abdomen laterally with short rather sparse hairs. Dorsal locomotory ampullae bulge, with median longitudinal groove; with small granules forming two transversely elongate ellipses, and short setae forming transverse row. Length of body 18 to 20 mm, width of head up to 3.0 mm.

Pupa (Figure 181): Head moderately bent under; inner side of frons at base of antennae with pair of large spinescent setae, and six setae forming transverse row on anterior margin at base of clypeus. Antennae arcuate, flexed to sides.

Pronotum bulges, smooth, narrows somewhat anteriorly, with distinct (female) or less distinct (male) flange on anterior margin; acicular spinules at base form one paramedial field. Metanotum convex, with barely perceptible dashlike transverse striation and minute spinules forming two tufts at base.

Abdomen with almost parallel sides, narrows considerably from segment VI posteriorly. Abdominal tergites bulge, with median longitudinal groove; in posterior half with acicular spinules on protuberant coriaceous base forming transverse row broadly interrupted medially (eight

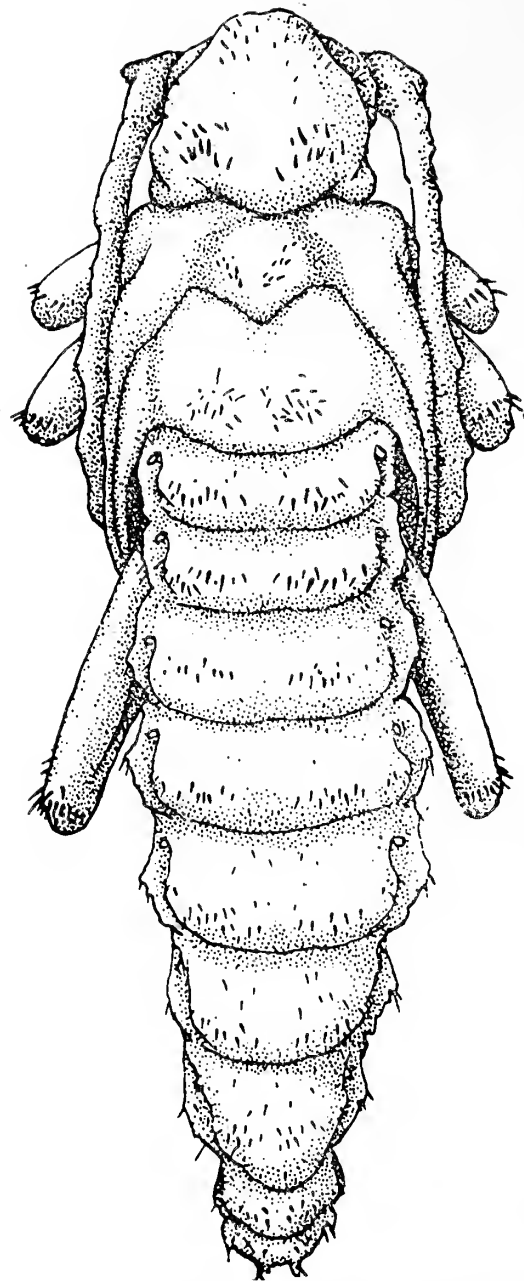


Figure 181. Pupa of *Anoplodera sequensi* (Reitt.).

to twelve paramedial spinules). Tip of abdomen obtuse, bound by carina set with spinules, and with pair of widely separated small urogomphi dorsally. Valvifers of female contiguous, large, laterally produced at apex. Length of body 10 to 12 mm, width of abdomen 2.5 to 3.0 mm.

297 *Material:* Western and eastern Siberia. Adult insects over 3,000 (108 raised in the laboratory), larvae 68, pupae 21 (male and female).

Distribution: Covers almost all of northern Asia, from eastern foothills of the Urals to Pacific Ocean coast; northern Mongolia, northern China, and Japan.

Biology: Inhabits coniferous and mixed vegetation. Highly numerous in forests of foothills of Altai, the Sayans, and Tuva. Beetles sighted end of May up to last 10 days of August. En masse flight observed end of June and in July. In Altai, over many seasons, 2,103 beetles were collected: 0.1%—end of May, 16.1%—June, 79.1%—July, and 4.7%—

August. Beetles active in warm clear weather, feed on pollen of flowers, mate, fly from one plant to another, and so forth. In cloudy weather, as the temperature falls, activity of beetles decreases and they hide in grass cover. Female lays eggs in bark crevices of dead trees of Siberian fir (*Abies sibirica*), Siberian larch (*Larix sibirica*), Siberian stone pine (*Pinus sylvestris*), and other conifers. Colonizes stumps as well as trunks of standing trees up to 37 cm or more in diameter. One female can lay over 30 eggs. Ovaries of two females taken from flowers contained 32 eggs in each. Development of eggs at 14 to 31°C (average 20°C) continued for 16 to 27 days, average 18.6 days. In the forests of Salair in 1968 larval hatching was observed from last 10 days of July up to middle 10 days of August. Larvae maximum (52.8%) in first 10 days of August.

On hatching larvae bore into bark, initially live underneath it, then bore deeper into wood; they make galleries there from bottom upward in upper layer and plug them with frass. Width of gallery 6.0 to 7.0 mm. Pupal cell made along trunk in upper part of gallery. Larva nibbles an exit to trunk surface, leaving a layer of wood about 1.0 to 2.0 mm. Length of cell 18 to 25 mm, width 5.0 to 7.0 mm. Larvae pupate in cell with head upward (toward exit).

Pupation usually occurs after second hibernation, commencing in May and ceasing end of June. Pupae maximum in second half of June. Beetles emerge from pupae three to four weeks later. Development of some pupae delayed for up to 30 days or more. Beetles emerge from May through middle 10 days of July and remain in pupal cell for five to seven days. They then abandon cell through exit made by larva, nibble round opening 3.5 to 4.0 mm in diameter, and escape through it onto trunk surface. Gonads are underdeveloped and supplementary feeding is required. Weight of larvae before pupation 36 to 112 mg, pupae 33.5 to 106.0 mg, and adult insects 25.5 to 74.5 mg. No significant differences in weight indexes observed between male and female during metamorphosis (Tables 11 and 12).

Table 11. Weight variation in *Anoplodera sequensi* (Reitt.) during metamorphosis

Sex	During pupation				During adult formation			
	No. of insects	Weight, mg		Weight reduction, %	No. of insects	Weight, mg		Weight reduction, %
		Larvae	Pupae			Pupae	Adults	
Male	2	139.0	132	5.1	10	679.6	464.3	31.7
Female	4	416.9	375	10.0	10	857.7	593.1	30.0

Nivellia extensa (Gebler), *Clytus arietoides* Reitt., *Anoplodera variicornis* (Dalm.), and others found together with this species on the same trees.

298 12. ***Anoplodera renardi*** (Gebler.)

Gebler, 1848, *Bull. Soc. Nat. Moscou*, 21, 1, 420 (*Leptura*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 380 (*Leptura*).

Adult (Figure 182): Close to *Anoplodera sequensi* (Reitt.). Differs in stable monochromatic black body. Head with distinct dense punctation, cervix comparatively long, temples slightly suspended or slightly sloped; with long erect hairs. Frontal tubercles at base of antennae indistinct. Antennae, especially in male, commencing from 5th segment thicken notably toward apex, reaching beyond 0.50 (female) or 0.66 (male) length of elytra; 3rd antennal segment longer than 4th, equal to 5th or slightly longer.

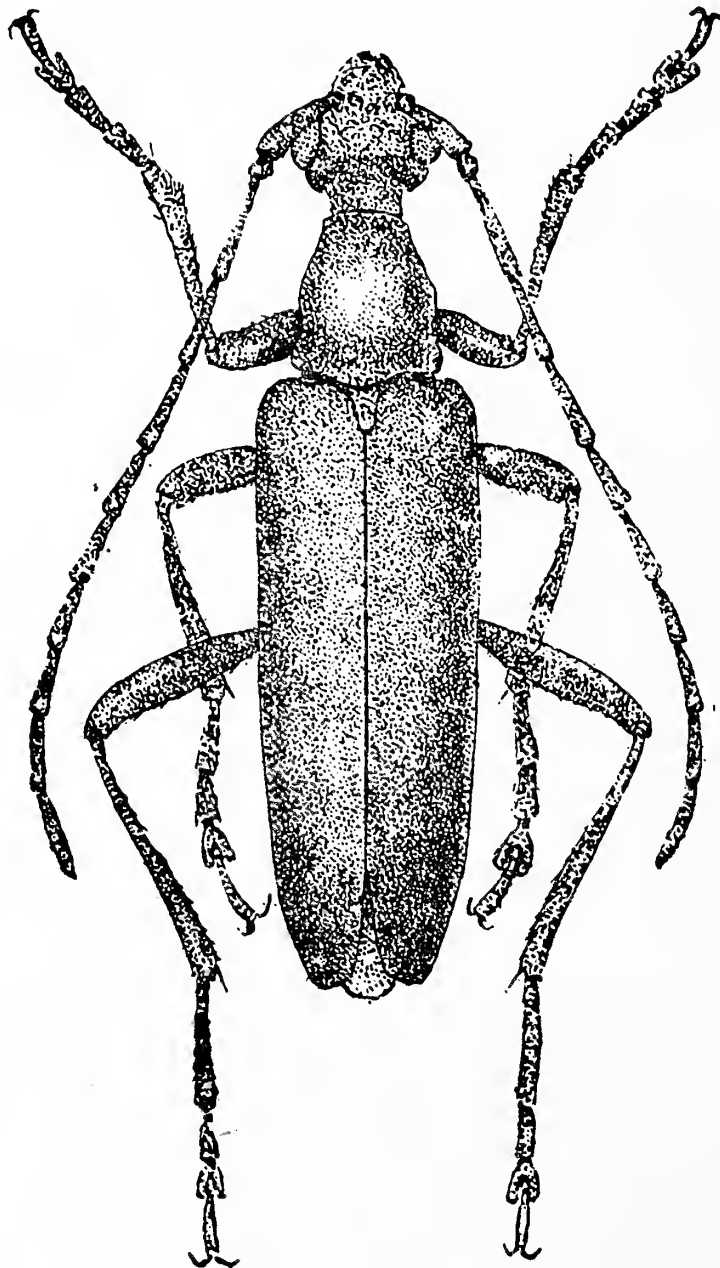


Figure 182. *Anoplodera renardi* (Gebler.).

Pronotum convex, somewhat longer than width at base, broadens more in female, with narrow flange on anterior margin, narrow transverse groove at base; dense umbilicate punctation imparts matte tone; with erect sparse hairs.

Elytra with parallel sides, convex, straightly truncate apically, with dense punctation and short semiadherent light-colored hairs. Legs slender; hind tibiae usually straight, not longer (male) or only slightly longer (female) than tarsi. First segment of hind tarsi longer than all successive segments together. Entire body black. Claws and spurs of legs light rust. Length of body 7.0 to 12.0 mm.

Egg: White, elongate, gently rounded at poles. Chorion with tiny cellular sculpture. Cells five- or six-faceted, spaces between them narrow. Length 1.5 mm, width 0.4 mm.

Larva (Figure 183): Similar to larva of *Leptura sequensi* (Reitt.). Differs from it in poorly developed locomotory ampullae on abdominal tergite VII and fewer hairs on hypostoma. Head slightly narrows anteriorly. Epistoma narrowly triangular, notably impressed in posterior half, bound laterally by straight distinct frontal sutures, medially divided by longitudinal rusty suture smoothed in anterior third; with long setaceous hairs forming two transverse rows, one in anterior half and second (posterior) beyond middle. Lateral hairs occur in region of frontal sutures. Hypostoma bulges slightly, almost flat, narrows somewhat anteriorly, not rounded laterally, with straight sutures, broadly emarginate apically and basally, with narrow white median longitudinal band and setaceous hairs (12 on each side of longitudinal band). Clypeus com-

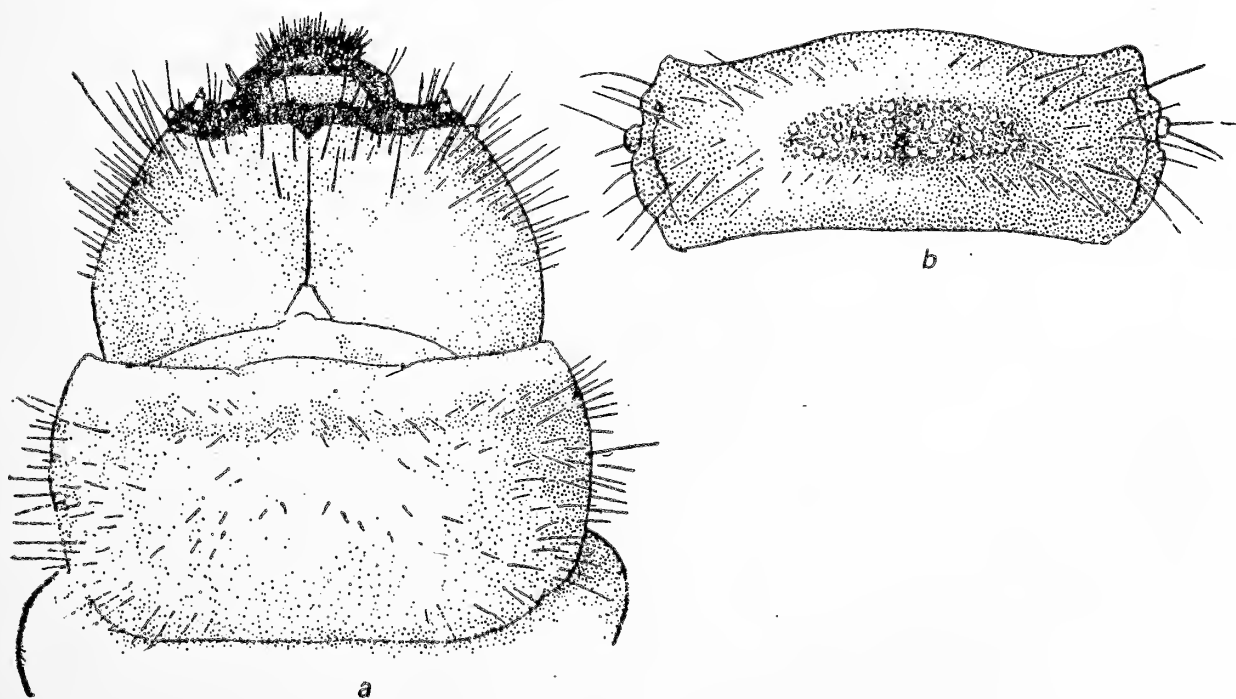


Figure 183. Larva of *Anoplodera renardi* (Geb.).

a—head and pronotum; b—abdominal tergite with locomotory ampulla.

paratively short, broad, white, brownish only at base. Labrum transversely oval, bulging and lustrous on disk, with three long lateral setae basally forming transverse row, and short dense setae along anterior margin.

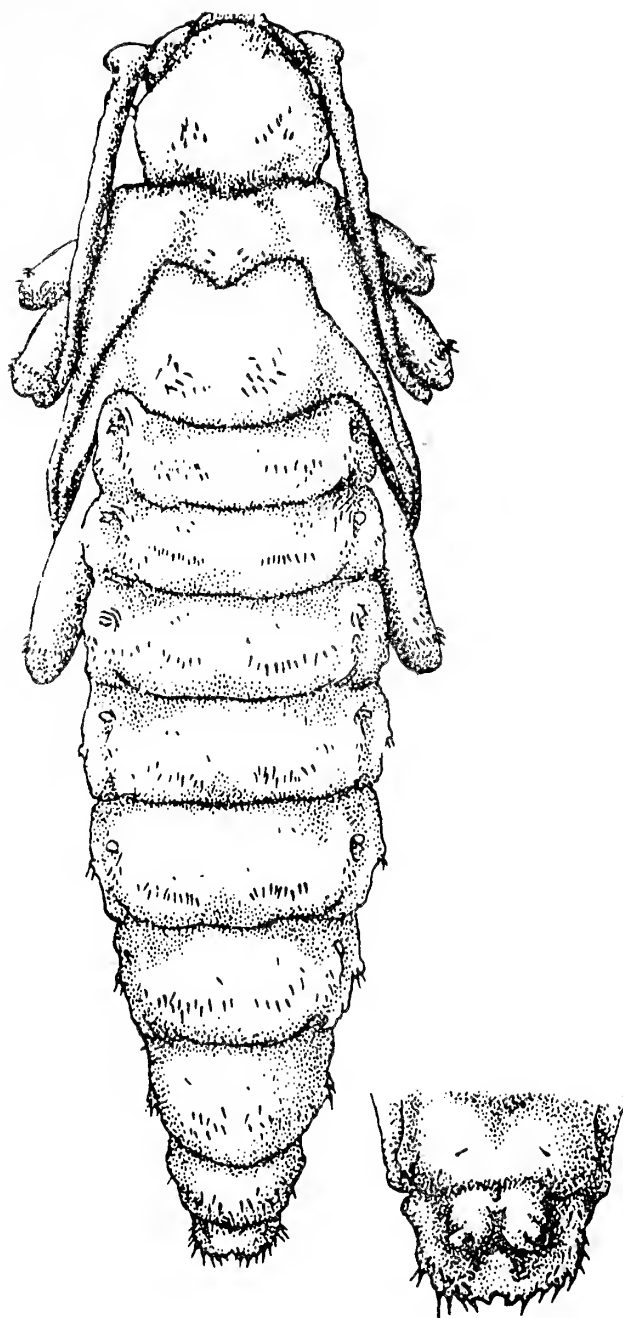
Pronotum 2.0 times wider than long, broadens somewhat anteriorly, bulges slightly, with sparse hairs laterally and in middle third. Pronotal shield with indistinct short lateral longitudinal fold, weakly striate, with stray setae on anterior margin and at base. Prosternum with sparse long setaceous hairs. Eusternum coriaceous, not sclerotized, without spinules, smooth, without striation, with stray hairs laterally, usually three hairs on each side.

Abdomen laterally with sparse tender hairs. Dorsal locomotory ampullae with minute granules forming on each of first six abdominal tergites four transverse rows arranged in two transversely elongate ellipses (inner and outer). Locomotory ampullae on tergite VII faint, in form of transverse indistinct granulate swelling, sometimes smoothened. almost imperceptible, especially in I-instar larvae. Body white. Anterior margin of pronotum with broad transverse rusty band interrupted medially by narrow white clearance. Head rusty, anterior margin of epistoma dark brown. Length of body 16 to 18 mm, width of head 2.1 mm.

Pupa (Figure 184): Differs from other species of this genus in poorly developed urogomphi at tip of abdomen, which are not distinguishable among other spinescent processes. Body moderately elongate. Head behind antennal base and on occiput transversely impressed, with tubercular prominences set with four setae on sides of frons forming longitudinal row; raised on anterior margin, with six setae disposed in pairs. Antennae bent, annular, flexed to sides.

Pronotum bulges, smooth, narrows anteriorly, with transverse groove at anterior margin extending to lateral dent; basal spinules form two tufts (of seven spinules each), stray minute spinules on disk, and minute spinules on anterior raised margin forming two tufts (of five to six spinules each). Metanotum bulges insignificantly, with spinules in two groups (of nine to twelve spinules each) at base.

Abdomen narrows gradually almost from base to tip, medially with distinct longitudinal groove. Abdominal tergites bulge transversely, acicular spinules in posterior half usually form regular transverse row broadly interrupted medially. Abdominal tergites VII and VIII in posterior half with rare spinules forming single transverse field on each tergite. Tip of abdomen obtuse, bound by semicircular carina set with spinules. Urogomphi almost indistinguishable from other spinescent processes on tip of abdomen. Valvifers of female elongate, somewhat separated, and apically produced into lateral tubercle. Length of body 10 to 14 mm, width of abdomen up to 4.0 mm.



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Figure 184. Pupa of *Anoplodera renardi* (Gebler), female.

Material: Altai, eastern Siberia, Ussuri-Primor'e region. Adult insects 77, larvae 10, pupae three (female), and several larval and pupal exuviae from pupal cells with beetles.

Distribution: Western and eastern Siberia, Altai, Ob' to Pacific Ocean coast, Sakhalin, Kunashir; northern Mongolia.

Biology: Inhabits coniferous and mixed forests. Develops on coniferous trees. Beetles raised from larvae extracted from undergrowth of fir. Flight commences early June and ends in middle 10 days of August. Beetles maximum in first half of July. They feed on flowers and female lays eggs in bark crevices of dead fir and other coniferous trees. Mainly small branches and trunks of undergrowth up to 7.0 to 8.0 cm colonized. Larvae hatch from eggs in three weeks and initially live under bark, then make longitudinal galleries in upper layer of wood,

and plug them with frass. Pupal cell up to 20 mm long and 4.0 to 5.0 mm wide made at end of gallery.

Pupation of larvae occurs in second half of May and in June. First beetles emerge from pupae in early June and last beetles in early July. They nibble round openings (up to 4.0 mm in diameter) on surface of shoots and escape through them. Weight of larvae before pupation 20.3 to 63.0 mg, pupae 19.3 to 60.0 mg, and young adults just emerging from wood 16.3 to 50.0 mg.

13. *Anoplodera virens* (L.)

Linnaeus, 1758, *Syst. Nat.*, 10th ed., p. 397 (*Leptura*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 380-382 (*Leptura*).

Adult (Figure 185): Readily distinguished from other species by comparatively large body, dense green hair cover, and variegated antennae. Head markedly elongate in front of antennae, genae long, notably compressed (dorsal view), cervix well defined behind eyes, temples short and erect. Antennae in female extend beyond middle of elytra, slightly longer in male; 2nd antennal segment short and nodose; 3rd longer than 4th, equal to 5th; 3rd to 11th segments light rust basally and black apically.

Pronotum somewhat longer than width at base, bulges, with broad median longitudinal groove, narrow flange on anterior margin, transverse groove in front of base; with dense fused punctation, dense adherent and thin erect hairs. Scutellum broadly rounded posteriorly and with dense adherent hairs.

Elytra narrow markedly from humeri to apex and narrowly truncate apically; with very fine dense rugose punctation and dense adherent hairs turned from suture posterolaterally. Abdominal sternite V apically emarginate, with broad longitudinal groove (female) or without it (male). Body black. Hair cover green. Length of body 14 to 24 mm.

Egg: White, elongate, narrows markedly and pointed at one pole, rounded at the other. Chorion with very tender thin gridlike sculpture, barely perceptible under high magnification. Length 2.2 mm, width 0.4 mm.

Larva (Figure 186): Body large and thick. Head insignificantly retracted into prothorax. Epistoma triangular, broad, rounded or slightly pointed apically, with white unevenly diffuse transverse band in middle and numerous piliform setae here. Longitudinally impressed in region of median suture. Frontal sutures well developed, flexed inward at level of white transverse band. Hypostoma bulges, slightly narrows anteriorly, medially with white longitudinal striae; with setaceous pores, large ones on disk closer to midline, and smaller ones shifted laterally. Clypeus smooth, lustrous, slightly narrows anteriorly, white, brownish basally.

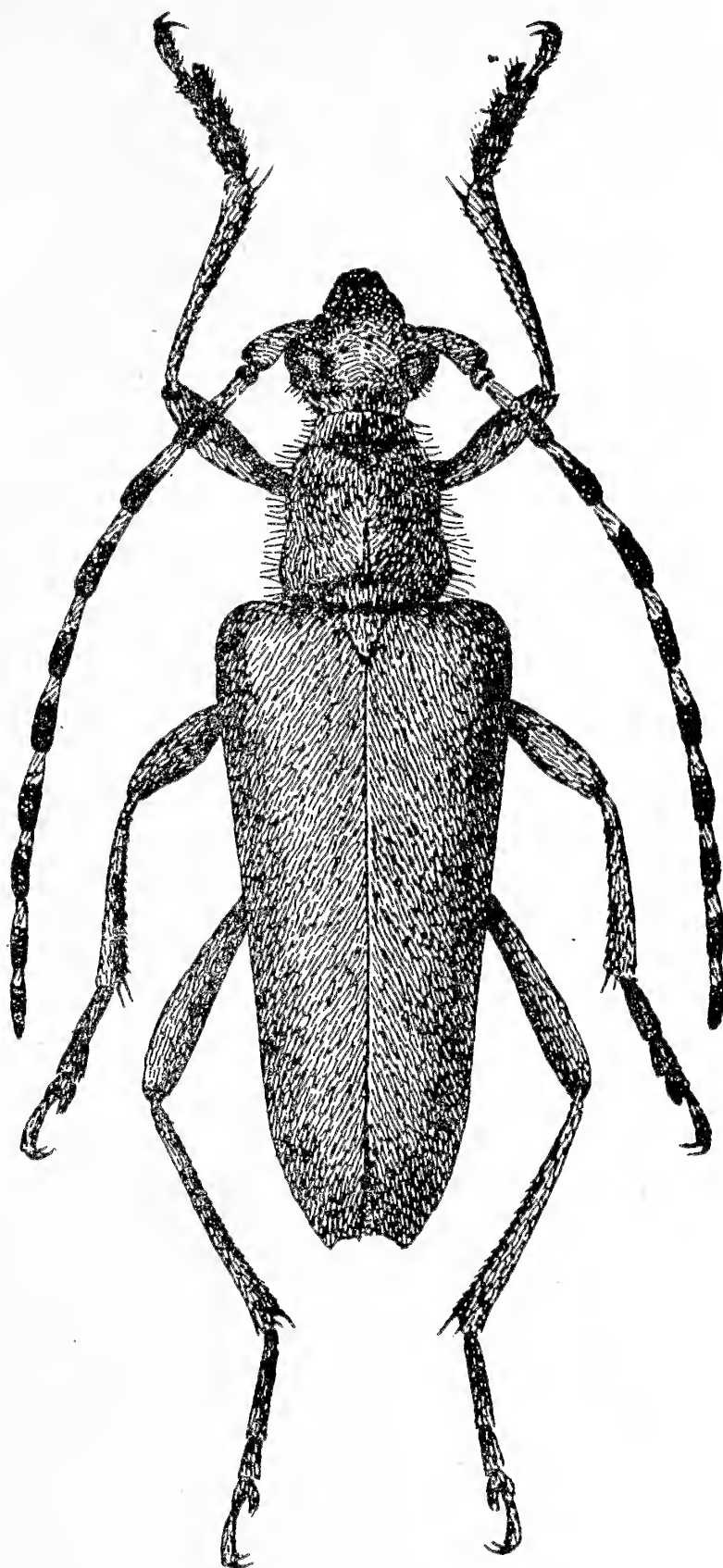


Figure 185. *Anoplodera virens* (L.).

Labrum bulges slightly, narrowly rounded at anterior margin, glabrous on disk, with minute setae along margins, and long lateral setae basally. Labial mentum usually with 10 coarse setae at base forming transverse row. Mandibles massive, with small longitudinal streaks forming transverse band on outer side anterior to middle.

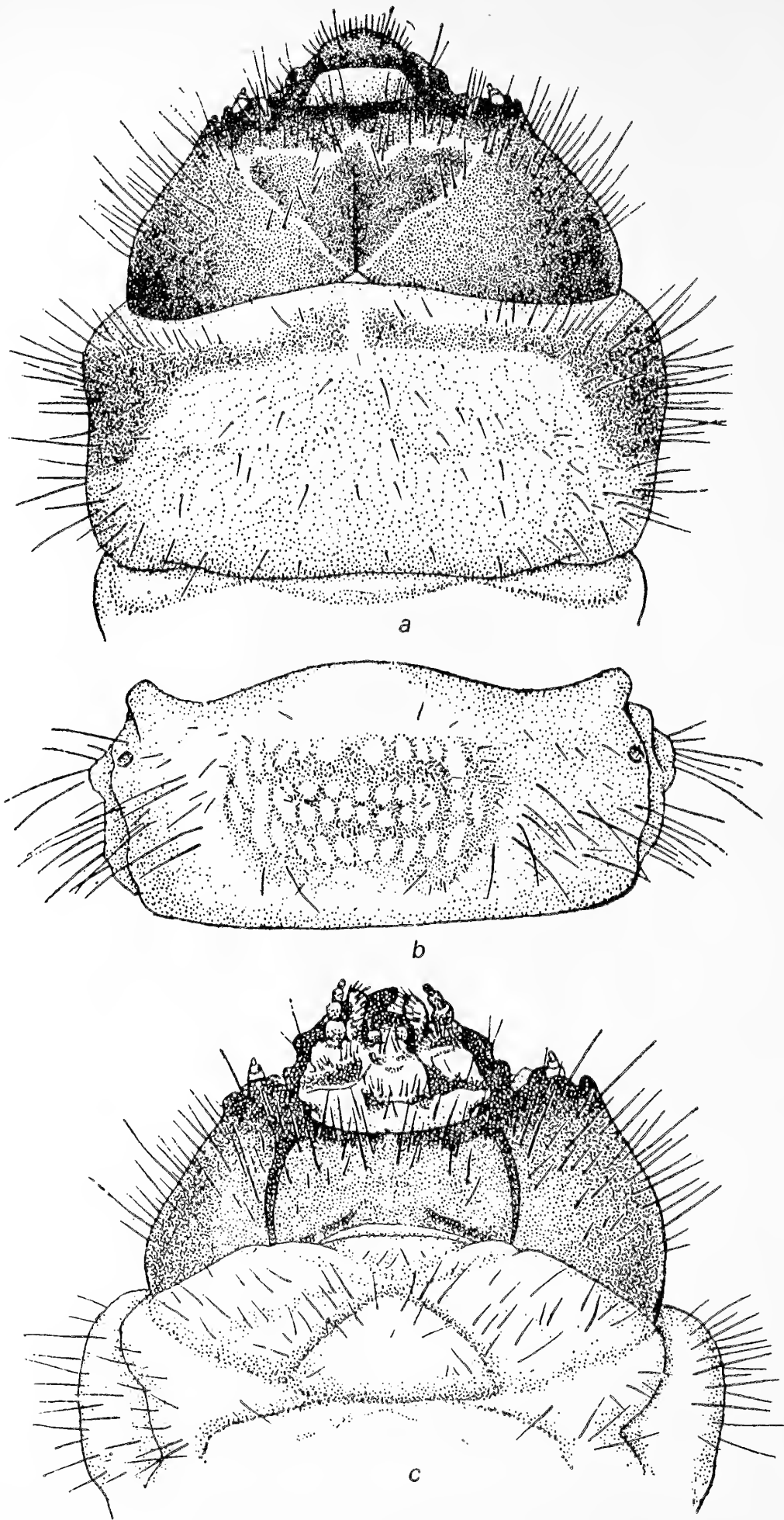


Figure 186. Larva of *Anoplodera virens* (L.).
 a—head and pronotum; b—abdominal tergite with locomotory
 ampulla; c—head and prothorax (ventral view).

Pronotum transverse, bulges slightly, lustrous in anterior half, rusty laterally, with transverse rusty band on anterior margin becoming
 302 lighter in tone toward middle; thin setaceous hairs form lateral tufts and indistinct transverse row on anterior margin of transverse rusty band, and stray setae found on disk. Pronotal shield coriaceous, with hyaline sheen, fine sinuous striation, and short setae forming transverse row at base. Eusternum bulges, lustrous, not sclerotized, with long setaceous hairs laterally in anterior half; striation indistinct.

Abdominal tergites with sparse coarse hairs. Dorsal locomotory
 303 ampullae bulge, with large granules forming two transversely elongate ellipses (inner and outer), and paired and single setae between rows of granules of inner ellipse (three setae on each side). Length of body up to 35 mm, width of head 6.0 mm.

Pupa (Figure 187): Distinguished by large number of spinules on sides of frons at antennal bases, coarse spinules on mesonotum, and other features. Body large, comparatively thick. Head bent under, notably elongate anteriorly. Sides of frons at antennal bases with numerous subulate spinules forming an indistinct longitudinal row (10 to 11 spinules in row). Antennae flexed to sides, arcuate in second half, with apices turned toward elytra.

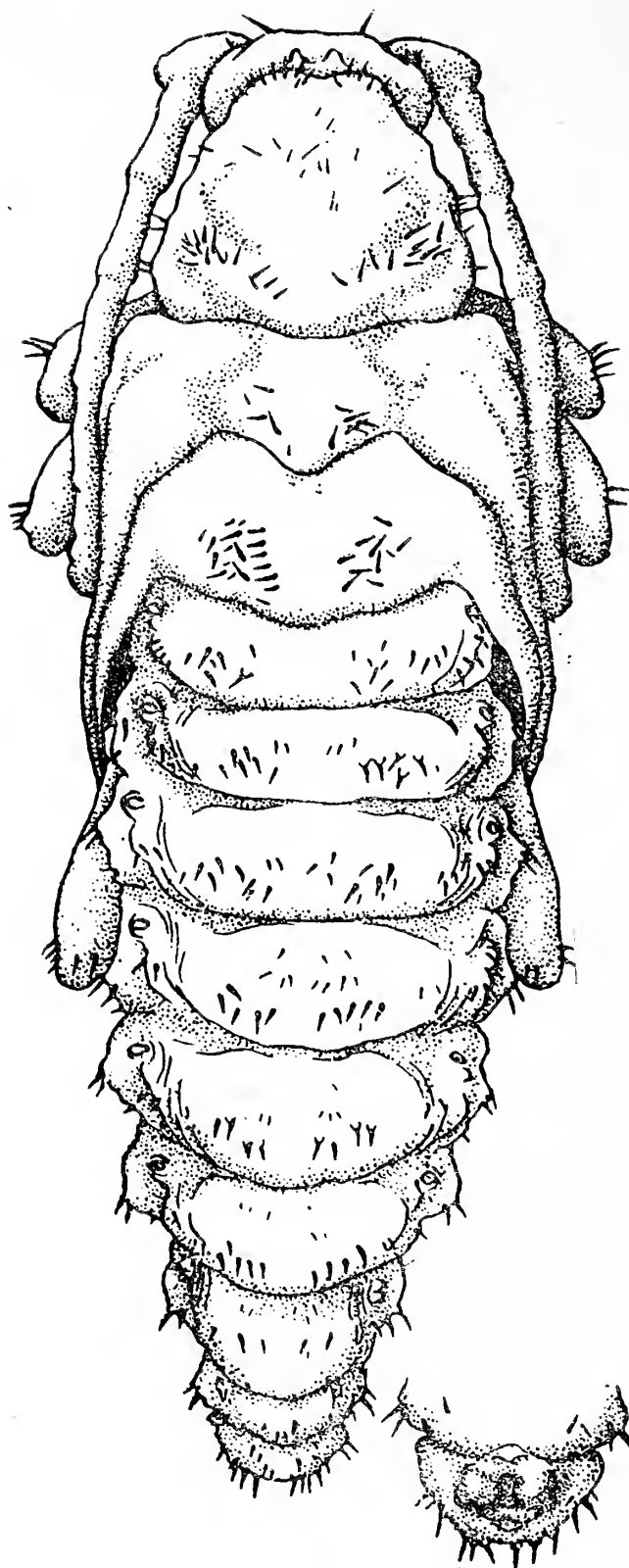
Pronotum narrows at anterior margin, with transverse prominence set with up to 14 acicular paramedial spinules at base, bulging disk, with transverse dashlike striation, isolated thin setaceous spinules, and sparse acicular spinules on anterior margin. Mesonotum bulges, transversely striate, with coarse subulate spinules laterally (five to six spinules on each side). Metanotum distinctly transversely striate, with two tufts of coarse spinules (13 each) in posterior half.

Abdomen narrows gradually toward tip. Posterior half of abdominal tergites with coarse subulate spinules forming indistinct transverse row broadly interrupted medially. Tip of abdomen obtuse, bound by horseshoe-shaped carina on which spinules long, subulate, and uniformly developed. Urogomphi not developed. Valvifers of female hemispherical, slightly produced laterally. Length 26 mm, width of abdomen 7.0 mm.

Material: Collected in various regions from the Urals to Pacific Ocean coast. Adult insects (male and female) over 1,000, larvae 18, pupa—one female, and several exuviae with beetles from pupal cells.

Distribution: Palearctic, from Atlantic to Pacific Ocean; in northern Asia covers the Urals, western and eastern Siberia, Primor'e, Kamchatka, and Sakhalin and Kuril, Islands. Reported from northern Japan and northern Mongolia. Highly numerous in the taiga zone and mountain forest zone of western Siberia.

304 *Biology:* Inhabits coniferous forests. Highly numerous in foothills of



Altai, Tuva, and sparse vegetation of taiga plains. Flight commences mid-June and ends in middle 10 days of August. Mass emergence of beetles observed in July. Beetles feed on flowers of various plants, but very numerous on plants of Umbelliferae and Rosaceae, gathering pollen from them. In Lake Telets region during systematic collection 363 specimens were collected from flowers, of which 6.0% were found in June, 84.3%—July, and 9.7%—August. This essentially reflects the

seasonal population dynamics of this beetle. After mating female lays eggs in bark on old dead fallen pine (*Pinus sylvestris*), Siberian stone pine (*Pinus sibirica*), and other coniferous species. Fecundity comparatively high. Ovaries of one female collected from flowers contained 127 mature eggs. It should be noted that after laying the first batch of eggs, the female quite often feeds again. In nature, at a mean temperature of $18.6 \pm 0.6^{\circ}\text{C}$, larvae hatch from eggs 12 to 29 days (average 20.9 days) after oviposition.

Larvae immediately bore into bark, then into wood, making longitudinal galleries there, and plugging them with frass. If the upper layer of wood is damaged by fungus, larvae enter the next layer that is not affected by rot. In dead fallen trees larvae generally make galleries from base to apex. Pupal cell made along trunk at end of gallery and terminal section of gallery plugged with fibrous frass. Larva pupates with head toward inlet, i.e., in direction of base. Length of cell 22 to 42 mm, width 10 to 16 mm.

Pupation commences end of May and ceases end of June. Beetles emerge from wood at end of first 10 days of June to early July, leaving behind flight openings up to 5.0 to 6.0 mm in diameter. They require supplementary feeding for gonads to mature. Weight of larvae before pupation 247 to 590 mg, pupae 231 to 572 mg, and adult insects 197 to 458 mg. Some larvae weigh 630 mg. *Anoplodera rubra* (L.), *Tragosoma depsarium* (L.), *Anoplodera rufiventris* (Gebl.), and other species often found together with this species on the same dead fallen trees.

8. Genus *Judolia* Muls.

Mulsant, 1863, *Coleopt. France Long.*, 2nd ed., p. 496; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 383–384; Gressit, 1951, *Longicorn Beetles of China*, vol. 2, p. 90 (*Anoplodera*).

Adult: Characterized by dense punctation, posterior angles of pronotum acutely produced laterally, elytra narrowly rounded apically, and other features.

Larva: Differs from larvae of the close genus *Anoplodera* in absence of notches on anterior pronotal margin, transverse yellow band on pronotum, and presence of dorsal locomotory ampullae on first seven segments of abdomen divided by grooves into three sections: middle transverse nongranulate sclerotized carina and anterior and posterior folds with more or less distinct granules. Moreover, lack of granulation on ventral locomotory ampullae is a characteristic feature of larvae of the genus *Judolia*. Variations occur in arrangement of granules into two rows [*Judolia erratica* (Dalm.)] to one row (*Judolia orthotricha* Plav.).

Pupa: Characterized by stocky, slightly curved body, presence of

numerous setae on pronotal disk, and small urogomphi on tip of abdomen.

The genus *Judolia* differs considerably from the genus *Anoplodera* in morphological features of larvae and pupae, and especially in biology, and hence these two genera cannot be combined.

Five species of this genus inhabit northern Asia: two [*Judolia sexmaculata* (L.) and *J. cometes* (Bat.)] inhabit coniferous species, and the other three [*Judolia longipes* (Gehl.), *J. erratica* (Dalm.), and *J. orthotricha* Plav.] deciduous species. However they share a common feature in colonizing the basal zone of trunks and roots of dead trees. The genus *Judolia* is comparatively early in origin. Hence its composition includes species widespread in the Holarctic region [*J. sexmaculata* (L.)], European part of western Siberia [*J. erratica* (Dalm.)], Altai—eastern Siberia [*J. longipes* (Gehl.)], and islands [*J. cometes* (Bat.)].

Type species: Leptura sexmaculata Linnaeus, 1758.

KEY TO SPECIES

Adult Insects

- 1 (2). Body elongate. Elytra narrow; total width 0.33 length. Pronotum elongate, rounded laterally, not laterally compressed in posterior half. 1. **J. sexmaculata** (L.).
- 2 (1). Body broadens at shoulders, usually thick, not elongate. Elytra narrow toward apex; total width 0.40 their length. Pronotum not longer than wide, generally angularly broadens laterally in anterior half.
- 3 (4). Pronotum with dense adherent hairs that form compact hair cover. 2. **J. erratica** (Dalm.).
- 4 (3). Pronotum with sparse adherent or erect hairs that do not form compact cover.
- 5 (8). Pronotum narrows steeply in anterior third, markedly compressed laterally in posterior half, and broadens slightly at base.
- 6 (7). Elytra with simple dense punctation, not striate. Pronotum with long thin erect hairs. 3. **J. orthotricha** Plav.
- 7 (6). Elytra with notched rugose punctation. Pronotum with short adherent or semiadherent hairs. 4. **J. longipes** (Gehl.).
- 8 (5). Pronotum narrows gently toward apex, not compressed laterally in posterior half or only slightly compressed, broadens markedly at base, with posterior angles acutely produced laterally. 5. **J. cometes** (Bat.).

Larvae

- 1 (2). Middle transverse carina of dorsal locomotory ampullae on abdomen more or less granulate. Found on coniferous wood species. 1. **J. sexmaculata** (L.).
- 2 (1). Middle transverse carina of dorsal locomotory ampullae not granulate, sclerotized, and with minute spinules.
- 3 (8). Eusternum entirely covered with very dense hairs. Pronotal shield with sparse, sometimes indistinct setae, either erect or bent downward in various directions.
- 4 (5). Eusternum sclerotized only in small section of base, and sclerotization barely perceptible. Found on roots of birch. 2. **J. erratica** (Dalm.).
- 5 (4). Eusternum sclerotized throughout most of base, and sclerotization prominent.
- 306 6 (7). Pronotal shield with distinct brownish alveolate punctation that forms broken line turned angularly anteromedially. Found on pea-shrub. 3. **J. orthotricha** Plav.
- 7 (6). Pronotal shield with faint brownish alveolate punctation on anterior margin that does not form distinct broken line. Found in basal zone and on roots of sea buckthorn, possibly on other deciduous species. 4. **J. longipes** (Gebl.).
- 8 (3). Eusternum with six hairs, usually along anterior margin. Anterior half and sides of pronotal shield with very dense short thick rusty-red setae directed backward almost horizontally. Found on roots of coniferous wood species. 5. **J. cometes** (Bat.).

Pupae

- 1 (2). Pronotum gradually narrows anteriorly, elongate, not produced mediolaterally, in any case not broadened. Found in wood in basal zone of trunks of coniferous species. 1. **J. sexmaculata** (L.).
- 2 (1). Pronotum broadens medially, angularly produced laterally, and narrows steeply in posterior third.
- 3 (4). Transverse carina on anterior margin of pronotum continuous, not interrupted medially. Found in soil around roots of birch and oak. 2. **J. erratica** (Dalm.)
- 4 (3). Transverse carina on anterior margin of pronotum higher, interrupted medially.
- 5 (6). Setae on pronotal disk directed in various directions; anterior setae on initial abdominal tergites directed forward and posterior setae posteromedially. Found in wood in basal zone of trunks

- and in roots of deciduous species. . . . 4. **J. longipes** (Gehl.).
- 6 (5). Setae on pronotal disk directed backward or distinctly erect; setae on initial abdominal tergites directed posteromedially.
- 7 (8). Setae on pronotal disk thin and piliform, quite often curved. Found in basal zone of shoots of pea-shrub. 3. **J. orthotricha** Plav.
- 8 (7). Setae on pronotal disk thick and acicular, not flexed. Found in soil around roots of coniferous trees. . . . 5. **J. cometes** (Bat.).

1. **Judolia sexmaculata** (L.)

Linnaeus, 1758, *Syst. Nat.*, 10th ed., p. 398 (*Leptura*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 386-390; Gressit, 1951, *Longicorn Beetles of China*, vol. 2, pp. 90-91 (*Anoplodera*); Kojima and Hayashi, 1969, *Insect Life in Japan*, vol. 1, p. 28.

Adult (Figure 188): Differs from other species in more elongate body and compact transverse groove at base of pronotum. Head between upper lobes of eyes glabrous, impressed transversely and broadly, with smooth median longitudinal suture; with dense large punctation, and long erect hairs in tufts on temples. Antennae extend considerably beyond middle (female) or almost reach apex (male) of elytra; 2nd antennal segment short and nodose; 3rd longer than 4th, equal to 5th.

Pronotum more (male) or less (female) elongate, companulate, narrows markedly in anterior third, with narrow flange on anterior margin, narrow uninterrupted transverse groove at base, and posterior angles produced laterally; dense round punctation, erect light-colored hairs, and sometimes with or without smooth median longitudinal groove. Scutellum triangular, slightly elongate; with dense minute punctation.

- 307 Elytra bulge, more or less elongate, with parallel sides (female) or narrow slightly behind humeri (male), individually rounded apically; with rugose punctation and short light-colored adherent hairs. Hind tarsi almost not shorter than hind tibiae, with 1st segment longer than successive two together. Body black; antennae black, rarely rusty; legs black; tibiae and tarsi sometimes partly rusty. Elytra yellow, apically black, with black spots: one on each side behind middle, one in region of each humerus, on margin, and common spot on disk anterior to middle. Sometimes these spots fuse transversely and form two distinct sinuous black bands. Sometimes black coloration so predominant that yellowish or rusty transverse bands or some stray light-colored spots barely visible on elytra. Rarely, elytra uniformly black. Length of body 8.0 to 13.5 mm.

Egg: White, almost identically gently rounded at poles, with barely perceptible fine cellular sculpture. Length 1.5 mm, width 0.4 mm.

Larva (Figure 189): Head broadly rounded laterally, narrows more

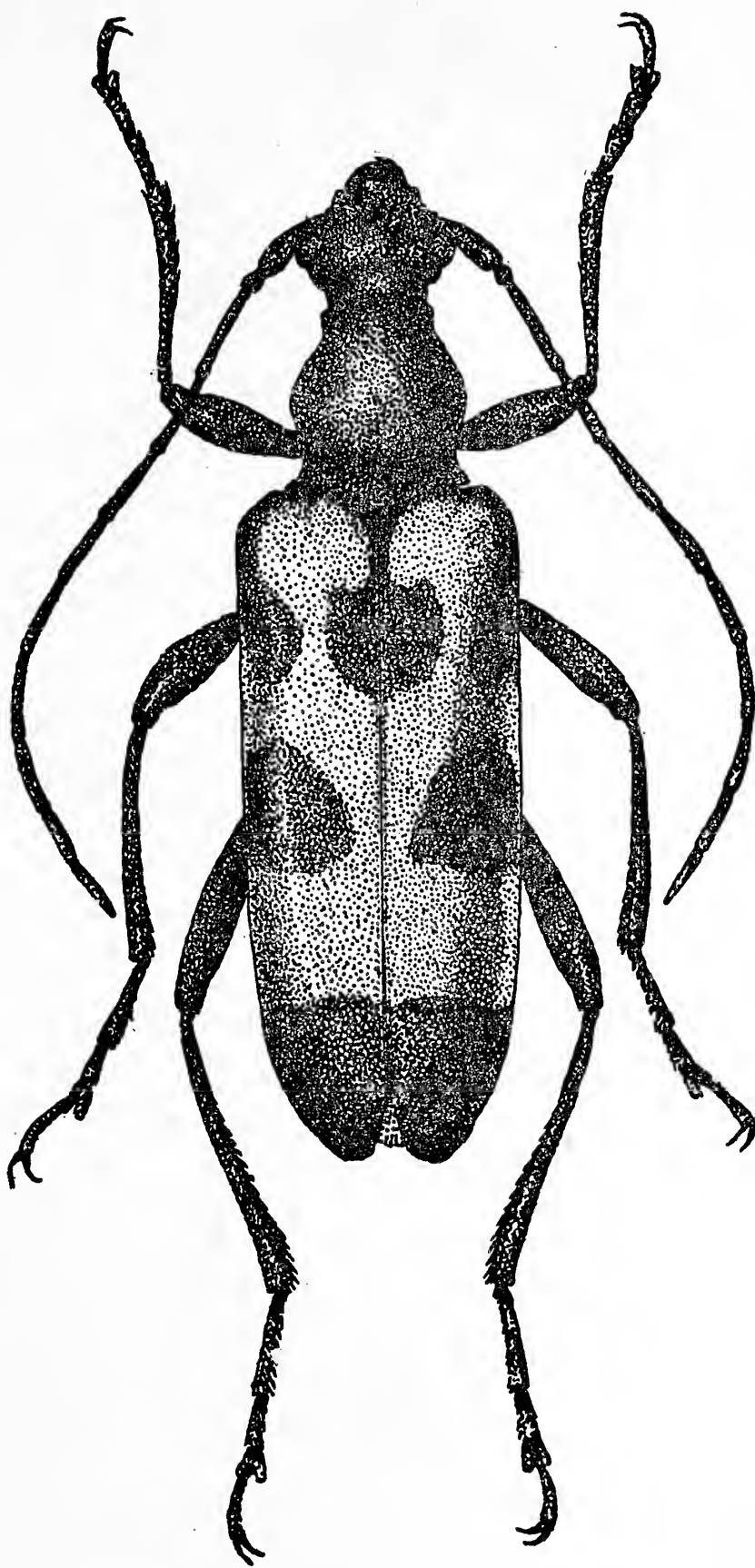
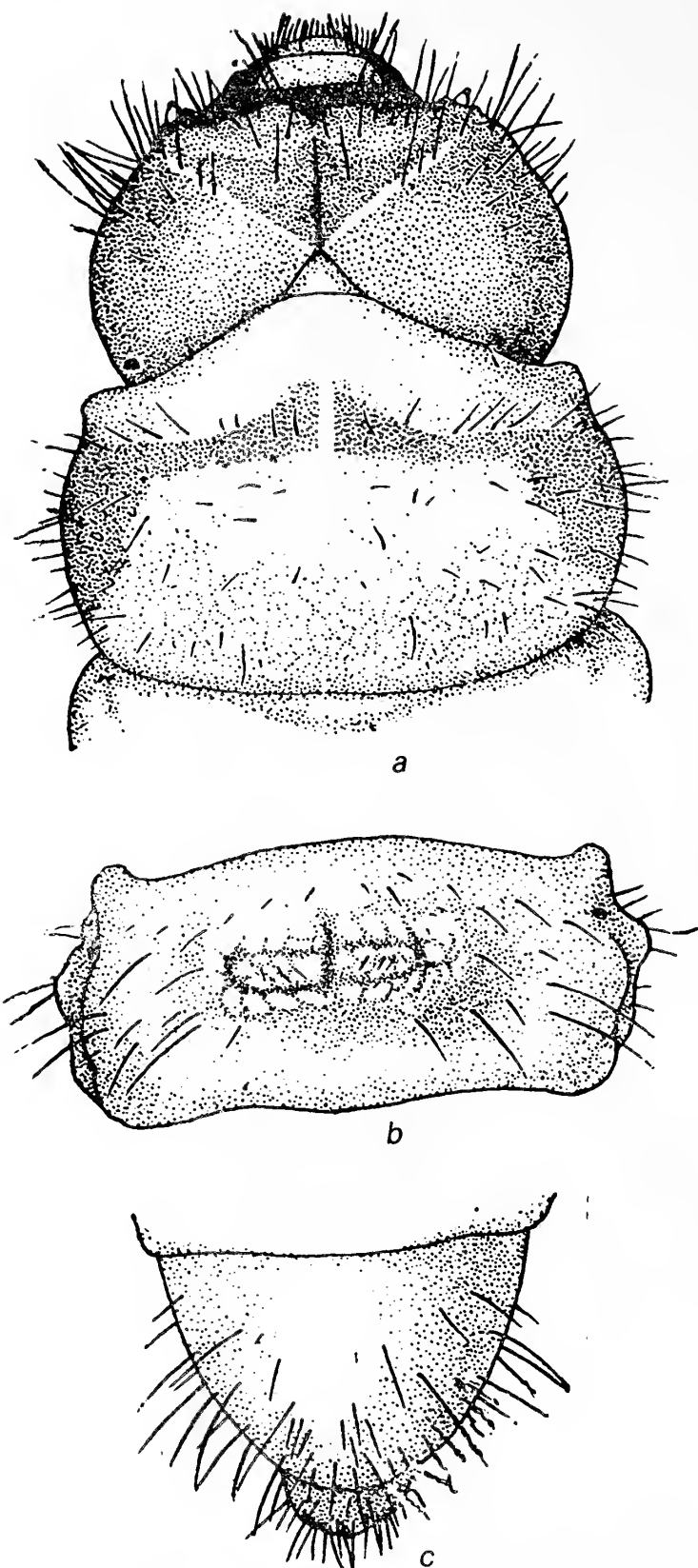


Figure 188. *Judolia sexmaculata* (L.).

anteriorly, slightly retracted into prothorax. Epistoma triangular, flat, bound laterally by straight white frontal sutures; brownish median longitudinal suture in posterior half disappears in anterior half (in mature larvae); four setae anterior to middle and two in posterior half form two distinct transverse rows. Additionally, three lateral setae present



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Figure 189. Larva of *Judolia sexmaculata* (L.).

a—head and pronotum; b—abdominal tergite with locomotory ampulla; c—tip of abdomen.

(closer to black margin). Sparse setaceous hairs on sides of head (parietals) in anterior half and single oval hyaline ocellus below antennal base. Hypostoma slightly convex, with median longitudinal white band, and five to seven setae on each side of band. Labrum transverse, straightly truncate or somewhat notched on anterior margin, with dense setae in anterior half.

Pronotum transverse, with rusty transverse band on anterior margin
 308 widening laterally into broad rusty field, and short setae forming somewhat indistinct transverse row in front of rusty band. Pronotal shield coriaceous, lustrous, bulges slightly, without lateral longitudinal folds. Prosternum with short setaceous hairs. Eusternum bulges, coriaceous, hyaline, with sparse setae, and minute brownish setae at base forming two small fields shifted toward middle. Meso- and metanota with minute spinules. Legs well developed, with brownish bent claws, and minute spinules on anterior clivus between legs.

Abdomen laterally with short sparse hairs. Dorsal locomotory ampullae on abdominal tergites I to VII with large granules forming indistinct transverse rows. Locomotory ampulla on tergite VII poorly developed, looks like transverse granulate band. Ventral locomotory ampullae barely granulate, form two very faint rows. Tergite IX with dense long rusty hairs on posterior margin. Body length of mature larva 26 mm, width of head 3.5 mm.

Pupa (Figure 190): Body notably concave. Head markedly bent under, flat between upper lobes of eyes, with median longitudinal
 309 groove, 10 to 13 setae around base of antennae on inner side, and pair of short setae on anterior margin on each side at base of clypeus. Antennae short, curved annularly, flexed to elytra ventrally.

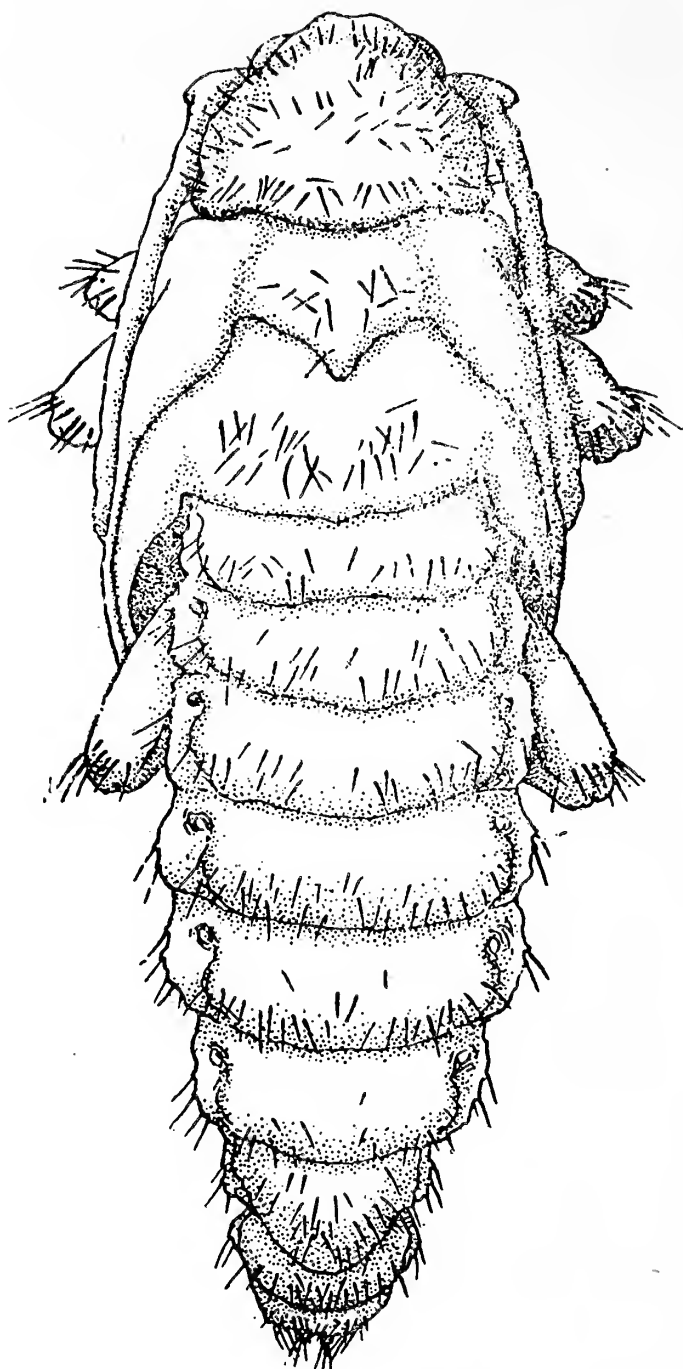
Pronotum bulges spherically, narrows anteriorly, with numerous setae on disk directed in various directions forming broad field that extends laterally; setae on posterior margin set on protuberant coriaceous base and form continuous row not interrupted medially, which extends from left posterior angle to right posterior angle. Setae on anterior margin form less distinct transverse row. Mesonotum with thin and metanotum with very thick, very dense setae forming two tufts.

Abdomen insignificantly narrows anteriorly, markedly but gradually posteriorly, with tip bent under. Abdominal tergites bulge, with sparse piliform setae in posterior half forming transverse band. Apical tergites of abdomen with dense setae, last tergite on posterior margin with pair of indistinct spinules. Valvifers of female cylindrical, contiguous, somewhat produced laterally at apex. Length of body 10 to 14 mm, width of abdomen 4.5 mm.

Material: From Altai, Tuva, Salair, and elsewhere, Adult insects 601, of which 108 raised in the laboratory, larvae 127, pupae 10 (male and female).

Distribution: From Atlantic to Pacific Ocean coasts; North America. Covers all of Siberia in northern Asia; northern Mongolia, northern China, Korea, and Japan.

Biology: Inhabits larch, spruce, fir-maple, and pine trees. Ecologically associated with coniferous wood species. Highly numerous in foot-



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Figure 190. Pupa of *Judolia sexmaculata* (L.).

hill regions and in mountain forest belt. Extends in mountains up to height of 2,000 m, i.e., up to boundaries of forest formation. Flight of beetles from end of May to last 10 days of August, maximum in July. In Altai, of 173 beetles collected systematically in one season 2.9% were found in May, 22.4%—June, 68.3%—July, and 6.4%—up to August 20. This data essentially reflects the seasonal population dynamics of these beetles. Beetles gather pollen from flowers and mate on them. Female lays eggs in bark crevices on thick exposed roots and on trunks in basal zone of dead or standing trees and on stumps. Colonizes larch, spruce, fir, pine, and Siberian stone pine (*Pinus sibiricus*). One female can lay over 100 eggs. Ovaries of one female picked from a flower on August 3rd contained 102 eggs. Larvae hatch from eggs 18

to 26 days after oviposition, bore into bark, make longitudinal galleries underneath it, plug them with frass, later penetrate deeper into wood, and advance upward in outer layer. After second hibernation mature larva makes pupal cell along trunk at end of gallery at a height of 10 to 30 cm above ground and pupates in it. Length of cell up to 15 mm, width up to 7.0 mm.

Pupation commences early May and continues up to end of June. Pupae maximum in middle 10 days of June. Beetles emerge from pupae after two to three weeks. Emergence of beetles from wood commences in May and ceases in second half of July. Four beetles, one pupa and one larva before pupation were found on June 26 near Shebalino in Altai on a larch stump. Weight of larvae before pupation 49 to 160 mg, pupae 44 to 133 mg, and adult insects 36.0 to 94.5 mg. One larva before pupation weighed 63 mg, pupa developed from it 57 mg, and adult emerging from this pupa 37.8 mg (male). Beetles emerge from wood with underdeveloped gonads and require supplementary feeding. *Leptura aethiops* Poda colonizes larch stumps together with this species.

310 2. *Judolia erratica* (Dalm.)

Dalman, 1817. In Schoenherr's *Gn. Ins.*, vol. 1, p. 3, nota p. 490 (*Leptura*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 390-393.

Adult (Figure 191): Differs in body shape, structure of pronotum, and elytra narrow apically. Body stocky, markedly broadens at shoulders. Head with dense minute round punctation; with steep sharp cervix, and suspended temples with silky hairs. Antennae in female extend beyond middle of elytra, in male slightly short of their apices; with short adherent hairs.

Pronotum bulges spherically, slightly compressed laterally in posterior half, narrowly rounded in anterior third, transversely impressed basally with septum medially between impressed parts, with bent narrow margin at apex; with dense uniformly deep punctation and dense silky adherent hairs directed backward. Scutellum triangular, short, impressed, with tender gray hairs.

Elytra bulge, narrow from humeri to apex, individually rounded apically, and gape (taper more on inner margin); with minute uniform punctation and adherent yellowish hairs. Femora moderately thick. Hind tarsi shorter (female) or almost not shorter (male) than tibiae; 3rd segment narrowly emarginate at apex. Body black. Antennae black, sometimes with brownish-rust tone. Elytra rusty-yellow, with black spots in anterior half (one on disk and two laterally), median sinuous transverse band black apically, and margin basally and laterally black. Pattern on elytra variable: sometimes median band disappears and some spots left instead. Sometimes, contrarily, black color displaces light color

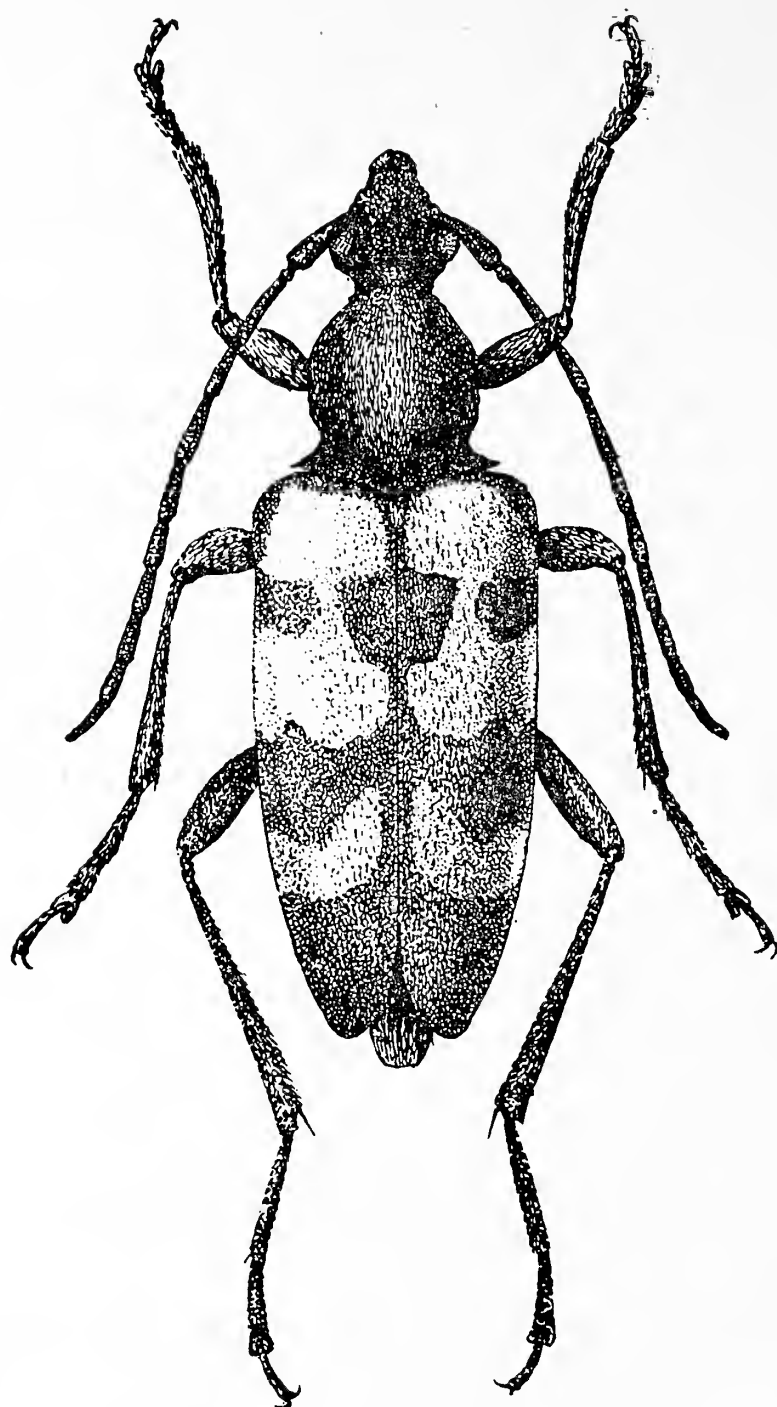


Figure 191. *Judolia erratica* (Dalm.).

and elytra entirely black or with stray light-colored small spots on black background. Length of body 7.0 to 12.0 mm.

Egg: White, elongate, with almost parallel sides, and broadly (identically) rounded at poles. Chorion with faint obliterated sculpture. Length 1.2 mm, width 0.4 mm.

Larva (Figure 192): Readily recognized by structure of dorsal locomotory ampullae of abdomen. Head transverse, slightly retracted into prothorax, notably bulges laterally. Epistoma short, somewhat impressed medially, with indistinct whitish diffuse transverse band anterior to middle that sometimes almost disappears. Hypostoma flat, with straight or slightly convex lateral sutures, narrow white longitudinal band, and

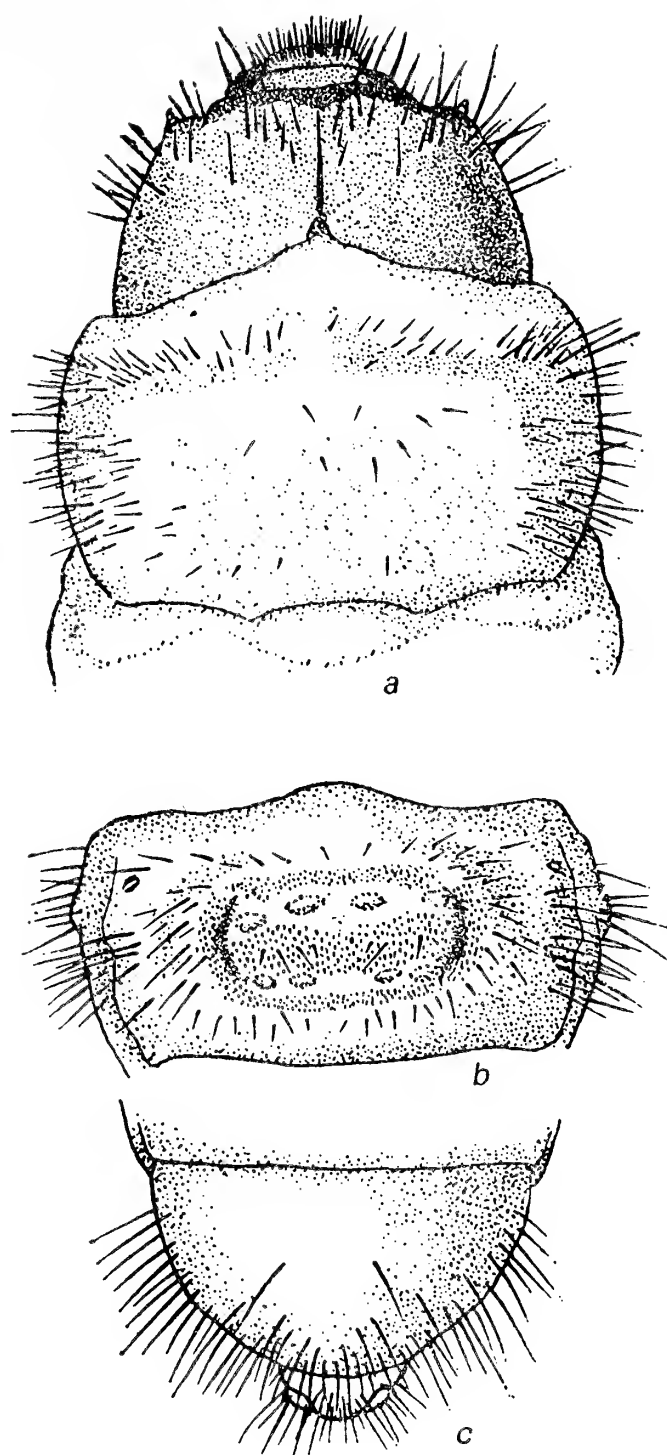


Figure 192. Larva of *Judolia erratica* (Dalm.).

a—head and pronotum; b—abdominal tergite with locomotory ampulla;
c—tip of abdomen.

three to four setae along sides of band. Clypeus broad and short. Labrum transverse, broadly rounded or obtuse at anterior margin, with long setae.

Pronotum transverse, bulges insignificantly, with long setaceous hairs laterally and short ones on anterior half of disk; brownish specks in middle of anterior third form small triangle in mature larvae; alveolar punctation on anterior margin of scutum forms broken line flexed forward angularly. Pronotal shield white, indistinctly bound laterally,

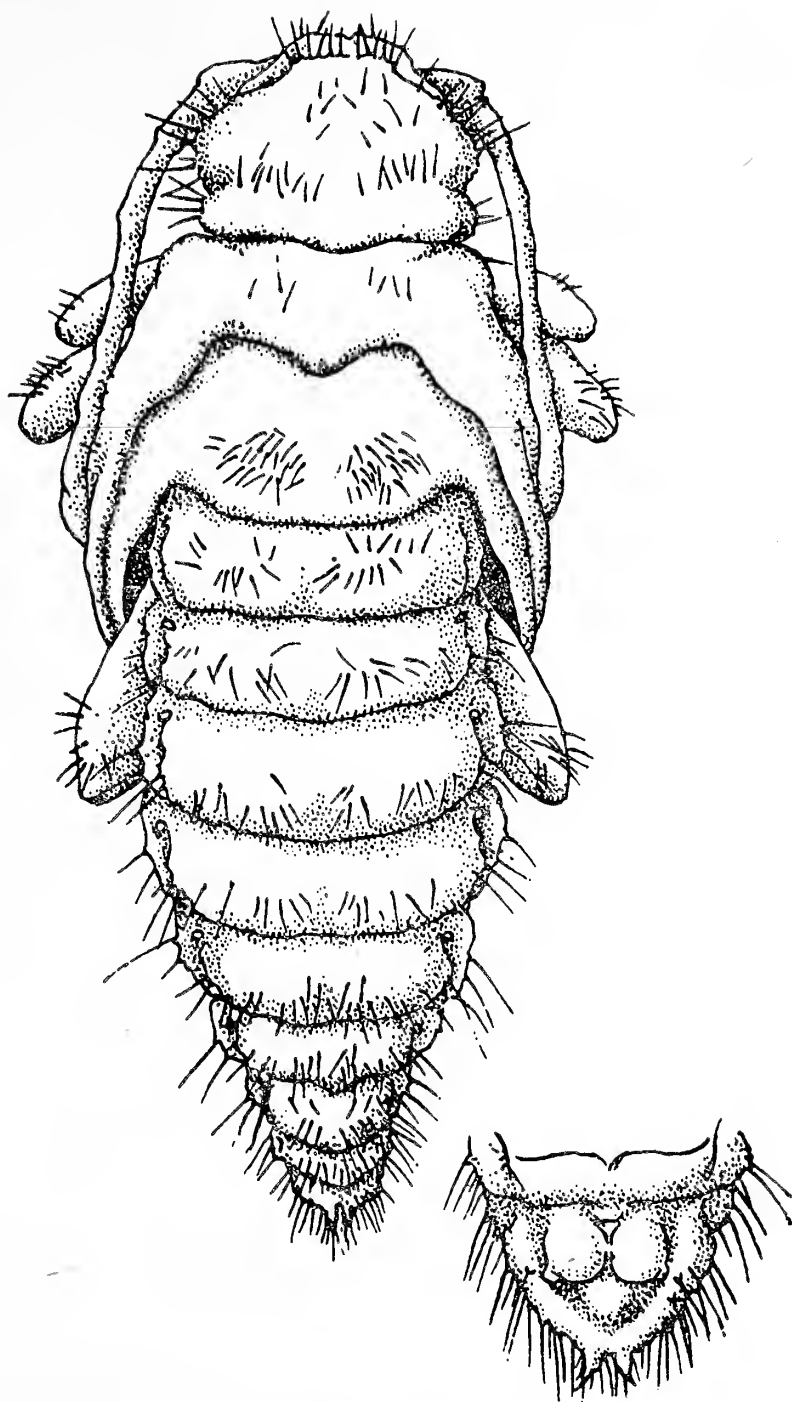
with setaceous hairs at base forming transverse row interrupted medially. Eusternum bulges, lustrous, coriaceous, with barely perceptible sclerotization at base.

Abdomen laterally with short hairs. Dorsal locomotory ampullae bulge, sclerotized, with narrow median longitudinal groove, almost not granulate, divided by two transverse grooves that join with longitudinal folds. Carina between transverse grooves compact, without granules, with dense minute spinules, and some setae forming transverse row. Ventral locomotory ampullae indistinctly granulate, with granules forming two rows along sides; without granules in region of median longitudinal groove and also on anterior and posterior margins, with minute spinules, coriaceous, without spinules elsewhere. Abdominal tergite VIII glabrous, with sparse hairs only in posterior third, long hairs laterally, and short hairs forming transverse band in middle. Tergite IX with long dense hairs on anterior margin, usually with pair of widely separated hairs immediately behind middle. Sternites VIII and IX glabrous in anterior half, with very dense hairs in posterior half forming one transverse band on each sternite. Anal lobes with dense setaceous hairs. Body white, head reddish-rust, anterior margin of epistoma dark brown or almost black. Mandibles black or blackish-brown. Pronotum rusty-yellow laterally, with broad yellowish indistinct transverse band on anterior margin. Length of body 26 mm, width of head 3.5 mm.

Pupa (Figure 193): Similar to pupa of *Judolia longipes* (Gehl.). Differs in arrangement of setae on pronotum and abdominal tergites. Body curves dorsally. Head elongate in front of antennae, transversely impressed behind antennae, bulges transversely between antennae and with thin setae here. Antennae short, arcuate, flexed to sides. Pronotum bent downward, bulges, rounded basally, roundly produced laterally; with dense setae on anterior margin forming transverse band, sparse setae on posterior margin forming transverse row, and very dense, straight, erect short setae on disk and sides. Hence pronotum appears uniformly setaceous. Mesonotum bulges, with more (male) or less (female) very dense minute setae laterally. Metanotum with median longitudinal groove and tubercular, densely setaceous prominences along sides of groove.

Abdominal tergites bulge, with median longitudinal groove; thin setae, usually directed backward, set on protuberant coriaceous base form transverse band, sometimes converting into transverse row. Tip of abdomen obtuse (ventral view), bound laterally by setaceous carinae that converge posteriorly at an acute angle, and with small adjacent urogomphi at tip. Valvifers of female hemispherical, laterally produced at apex. Length of body 14 mm, width of abdomen 5.0 mm.

Material: Western Siberia, Kurgan, Tomsk, Novosibirsk, Achinsk,



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Figure 193. Pupa of *Judolia erratica* (Dalm.), female.

and other regions. Adult insects 85, larvae 56, pupae—two males and three females, several larval exuviae with beetles and pupae from pupal cells. I raised beetles from 26 larvae on birch and two on oak.

Distribution: From Atlantic Ocean coast, Mediterranean Sea, to Yenisey; found south of 58th parallel. Sporadic in northern Asia, occupies forest-steppe zone. Not reported in the north.

Biology: Inhabits mature but sparse vegetation of birch and oak. Flight of beetles in June. En masse flight observed in July and early August. In Ob' region forest-steppe during systematic collection of beetles, 12 (17.7%) were found in June, 29 (42.6%)—July 21 (30.9%)—August, and six (8.8%)—September. Beetles feed on flowers, sighted

quite often on Umbelliferae, Compositae, and other plants. I collected a series of beetles from milfoil (*Archillea millefolium*). After mating female lays eggs on thin dead roots 1.0 to 3.0 cm thick in soil at a depth of 2.0 to 17.0 cm. Colonizes mainly uppermost dead roots of stumps, dead and even live thick-trunked trees of birch and oak with a trunk diameter of up to 18 cm or more.

- 313 Larvae live in roots at a distance of up to 0.5 to 2.0 m from trunk, make longitudinal galleries in wood, and plug them with fine frass. Width of gallery 8.0 mm, length up to 46 cm. Sometimes larvae make gallery in one direction, turn, and continue in opposite direction, and so forth. In one root 2.5 cm in diameter there were six adjacent longitudinal galleries. As a result the wood was completely damaged and only the bark tube, filled with frass, remained. In spring, after second hibernation, with the temperature rising to 10 to 15°C, mature larvae nibble an oval opening (3.0 mm × 5.0 mm) in bark along root axis and emerge; gallery at this site plugged with soil. They later make a pupal cell horizontal to root in soil at a depth up to 5.0 cm and pupate in it. Under laboratory conditions emergence of larvae from roots commenced at 10.4 to 13.0°C and continued at 14.0 to 16.9°C. Larval emergence was maximum at 10.4 to 14.8°C.

Larval stage at 14 to 15°C continues for 18 to 19 days. Pupae maximum at end of June. Young beetles, emerging from soil in June and July with underdeveloped gonads, require supplementary feeding. In a week or two thereafter eggs mature in female. For example, in one female dissected the second day after emergence, immature eggs were present in the ovaries and only the ovarioles were prominent, while in another female dissected 2.5 weeks after emergence, there were 106 mature eggs in the ovaries.

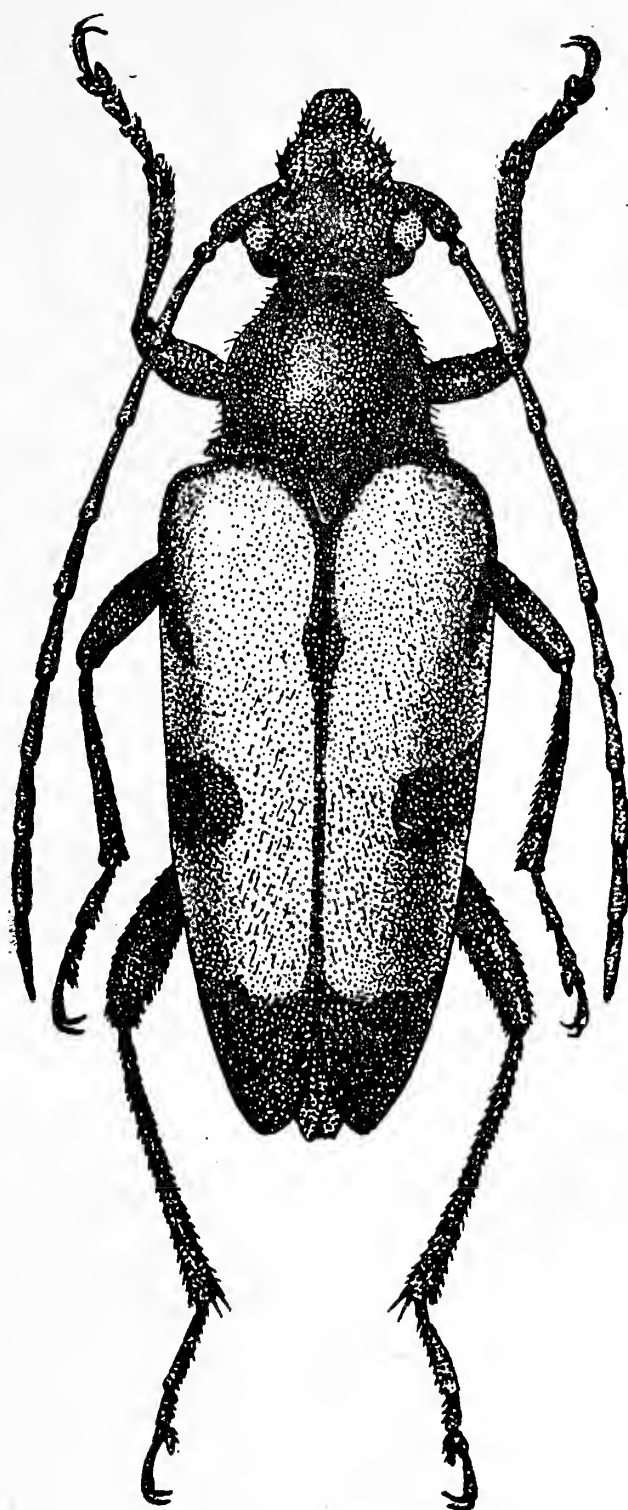
Weight of larvae before pupation 71 to 190 mg, pupae 64 to 155 mg, and adult insects one week after emergence 51.0 to 108.5 mg. In an experiment on metamorphosis from larva to pupa, the weight of both males and females decreased by 10% (weight of 11 larvae before pupation 1,403 mg and of pupae developed from them 1,265.5 mg), and from pupa to adult by 37.2% (weight of six pupae 710 mg and of adults emerging from them 445.9 mg).

Judolia erratica (Dalm.) colonizes sparse vegetation, clearances in felled forests, and individual trees standing in the open. It develops on birch in the Ob' region and on oak in the southern Urals.

3. *Judolia orthotricha* Plav.

Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 393-396.

Adult (Figure 194): Characterized by dense erect hairs on pronotum and variable coloration of elytra, legs, and abdomen. Body slightly

Figure 194. *Judolia orthotricha* Plav.

elongate. Head comparatively short with dense punctation; insignificantly bulges between antennae, with median longitudinal groove and sharp cervix. Antennae in female just reach beyond middle of elytra, in male reach apex of elytra.

Pronotum broad, not longer (female) or only slightly longer (male) than wide, with posterior angles acutely produced laterally, slightly compressed laterally in posterior half, broadly rounded in anterior half, especially in female, markedly narrows anteriorly, moderately bulges on disk; with dense round punctation and erect, sometimes dense

grayish-brown hairs imparting to pronotum dense setaceous appearance. Scutellum flat, triangular, with indistinct punctation.

Elytra bulge, with parallel sides (female) or slightly narrow posteriorly (male); with dense rather small punctation, shagreen spaces between punctures, with semiadherent short hairs, and individually rounded apically. Body black; antennae black, dark brown, or rusty. Elytra entirely yellowish-rust (ab. *decolorata* Plav.) or straw-yellow with black apex, black spot mediolaterally, and another black spot behind humeri (ab. *lateromaculata* Plav.), or monochromatic black (ab. *atripennis* Plav.), or black with some light-colored reddish spots (ab. *falsa*, ab. *rufomaculata* Plav., and others). Legs black or reddish-rust, with tarsi darkened apically. Length of body 7.0 to 11.0 mm.

Egg: White, elongate, rounded at poles, with barely visible fine sculpture.

Larva (Figure 195): Very close to larva of *Judolia erratica* (Dalm.) in structure of pronotum and dorsal locomotory ampullae. Differs in greater pubescence of tergite IX and other features. Head comparatively flat, insignificantly narrows anteriorly. Epistoma slightly impressed, rounded apically almost at right angle, and with more or less developed whitish transverse band anterior to middle. Head laterally in anterior half with sparse (stray) hairs, with elongate, usually black ocellus at base of antennae. Hypostoma flat, with straight sutures laterally, rounded

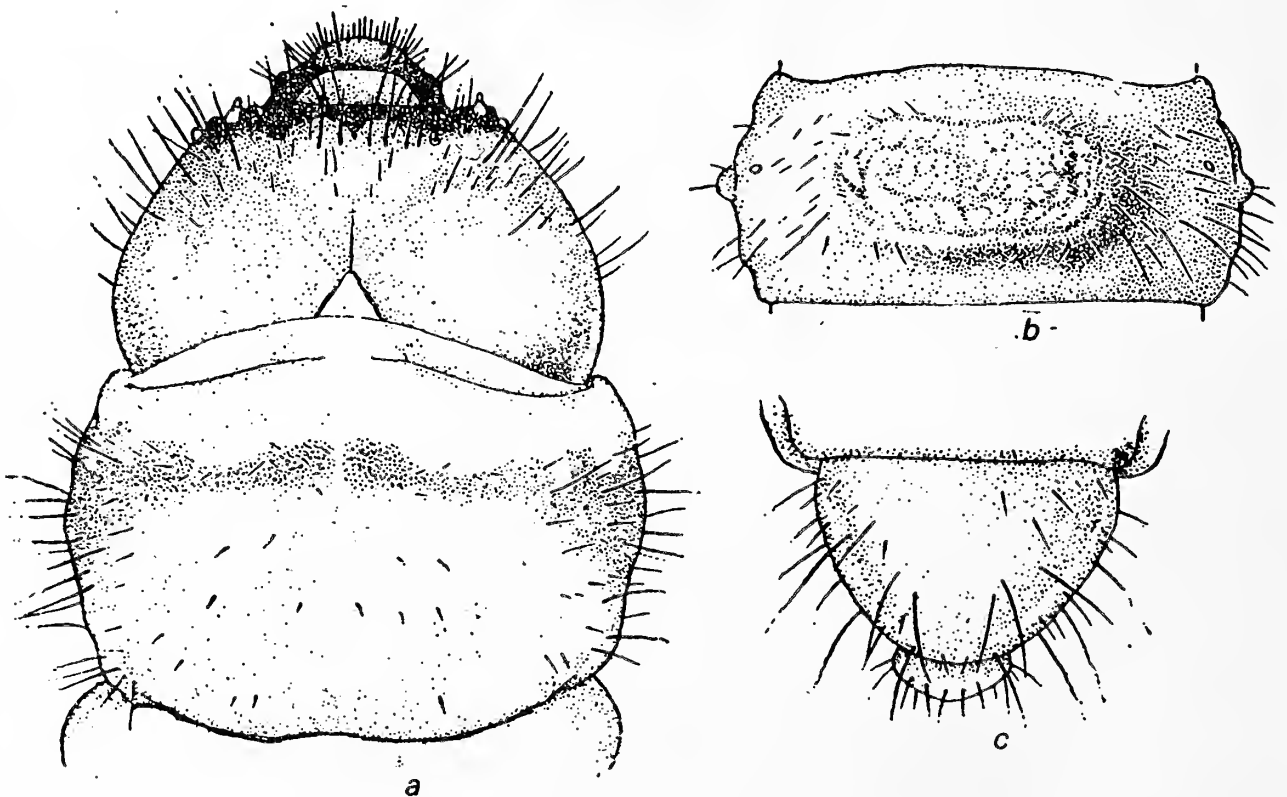


Figure 195. Larva of *Judolia orthotricha* Plav.

a—head and pronotum; b—abdominal tergite with locomotory ampulla;
c—tip of abdomen.

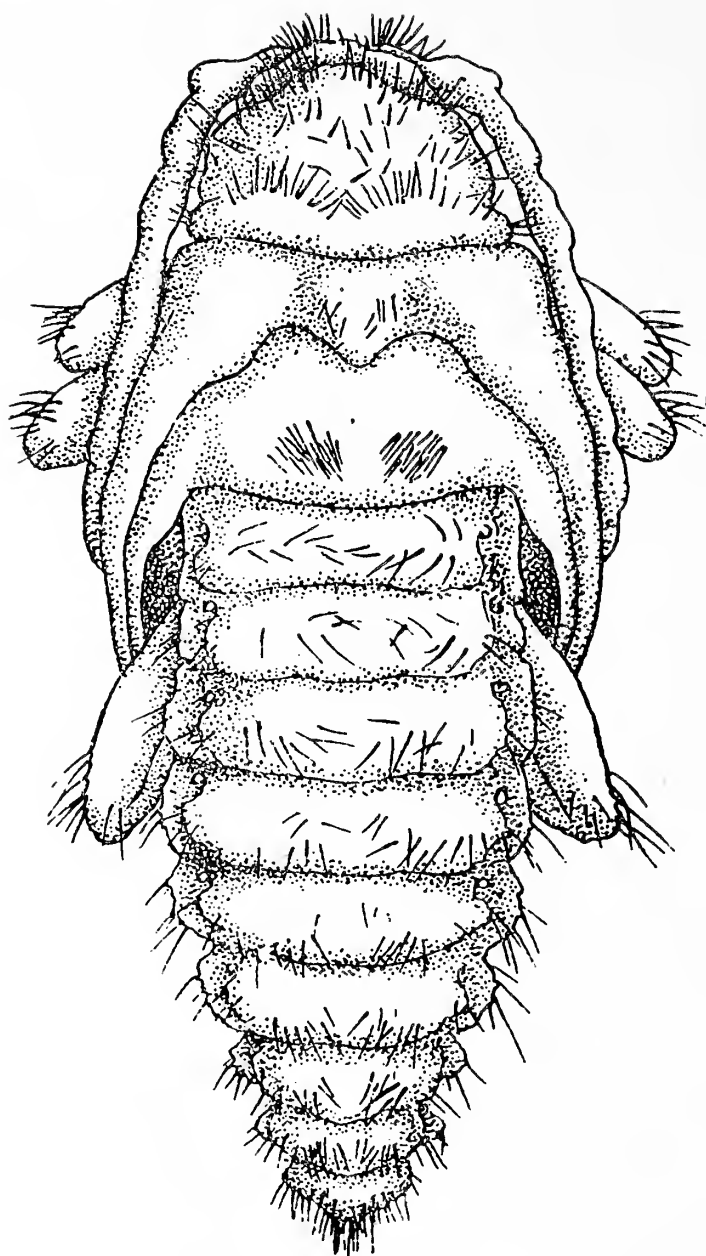
anterior angles, and narrow white gula. Clypeus trapezoidal, markedly narrows anteriorly, rusty-brown basally, whitish apically. Labrum transversely elongate, rounded laterally, obtuse anteriorly; with rusty setae, and rusty-brown basally. Mandibles short and broad (thick), broadly truncate or notched apically, with large lower rostriform denticle, smooth on outer surface of apex, with transverse impression medially, and carina on inner side that extends from apex of lower denticle and slopes toward base.

Pronotum bulges slightly on disk, with transverse rusty band set with short setaceous hairs behind anterior margin forming transverse field, glabrous lustrous area mediolaterally, short hairs posteriorly, and brownish specks in middle of anterior half forming small triangle. Pronotal shield white, with brown alveolar punctation on anterior margin and medially forming an acute angle directed forward, not bound laterally, merges with rest of pronotal surface, and with usual punctation on disk. Eusternum bulges, lustrous, with long setaceous hairs, sclerotized basally, with sclerotized field appearing as two matte fused spots.

315 Abdomen with long dense hairs. Dorsal locomotory ampullae bulge, divided by common longitudinal groove, two transverse grooves bordering nongranulate sclerotized transverse carina set with seven to eight setae, and anterior to this carina with minute granules; posteriorly without granules or only slightly granulate, sclerotized. Ventral locomotory ampullae with one row of granules, not granulate behind this row, and with minute spinules. Abdominal tergite VIII anterior to middle with short setae forming transverse row, and numerous setae behind middle forming transverse band. Tergite IX in anterior third (at base) glabrous; elsewhere with dispersed hairs. Abdominal sternite VIII covered for most part with setaceous hairs. Sternite IX in posterior half comparatively densely covered with hairs. Length of body up to 18 mm, width of head about 3.0 mm.

Pupa (Figure 196): Similar to pupa of *Judolia longipes* (Gehl.) in arrangement of setae on base of pronotum, and close to pupa of *J. erratica* (Dalm.) in arrangement of setae on abdominal tergites. Head in front of antennae short, does not narrow anteriorly, almost quadrangular, with numerous setae on sides of frons around antennae forming broad longitudinal band. Antennae flexed to sides, curved annularly.

Pronotum broadens in posterior half, narrows markedly in anterior half, with acute posterior angles, and broadly bulging disk, with numerous small thin setae forming broad transverse field, similar dense thin setae on anterior margin forming transverse band, and very thick setae on posterior margin set on protuberant coriaceous base forming dense transverse row medially bent angularly backward. Each side of this flexure with 13 to 17 setae. Mesonotum bulges slightly, with minute



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Figure 196. Pupa of *Judolia orthotricha* Plav.

setae forming transverse band interrupted medially. Metanotum flat, with narrow median longitudinal groove, and thick setae forming two dense tufts along sides of groove in posterior half.

Abdomen gradually narrows posteriorly from segment III. Abdominal tergites bulge moderately, with median longitudinal groove set with thin setae directed backward. Tip of abdomen (ventral view) triangularly obtuse, bound laterally by pubescent carina. Length of body 9.0 mm, width of abdomen 3.0 mm.

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Material: From Ubsunursk basin (Terekty-Khem) and Ulug-Khem basin (Kyzyl, Urguzu, and other places). Adult insects 15, larvae nine, pupa—one male.

Distribution: Tuva, Krasnoyar, Kansk. Possibly also occurs in northern Mongolia.

Biology: Inhabits parts of steppes covered with vegetative associations in which pea-shrub (*Caragana*) occurs. Beetles sighted from June

through August but maximum end of June and in first half of July. Female lays eggs in basal zone of pea-shrub shoots. Immediately on hatching larvae bore into shoot, make galleries initially under bark, then in wood, and plug them with frass. Larvae penetrate root from basal zone of shoot. Larval galleries longitudinal, width up to 10 to 12 mm, and sometimes fuse to cover a significant area. Not more than two larvae develop in one shoot. Wood is destroyed in thin shoots, sometimes to such an extent that only the pith is left. Colonizes dead shoots but also found in viable bushes. Larvae live in basal zone of shoots and in roots, never reaching higher where larvae of *Asias halodendri* (Pall.) developing on viable plants are found. Mature larva makes pupal cell up to 18 mm long and 4.0 mm wide.

Pupation occurs in June. Weight of larvae before pupation 39 to 52 mg, pupae 35 to 46 mg, and beetles 32 mg. *Judolia orthotricha* Plav. occurs sporadically in local steppe sections. In Tuva (Ubsunursk and Ulug-Khem basins) lives among pea-shrubs (*Caragana bungei*, *C. pygmaea*), mainly on river terraces.

4. *Judolia longipes* (Gebler)

Gebler, 1832, *Nouv. Mem. Soc. Nat. Moscou*, vol. 2, p. 67 (*Pachyta*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 396-398; Gressitt, 1951, *Longicorn Beetles of China*, vol. 2, p. 91 (*Anoplodera*).

Adult (Figure 197): Characterized by unusually wide color variation of elytra. Body stocky, thick in female, more elongate in male. Head between antennae convex, with narrow median longitudinal groove with dense flat punctation (spaces between punctures shagreen), short, barely projecting and densely pubescent temples, and not very sharp cervix. 317 Antennae barely extend beyond middle (female) or reach apex (male) of elytra; 3rd antennal segment equal to 5th, slightly longer than 4th.

Pronotum bulges uniformly, compressed laterally in posterior half, more (female) or less (male) broadens angularly, does not narrow much anteriorly, somewhat bent under at anterior margin, with compact transverse impression at base, and insignificantly elongate posterior angles; with very large dense punctation and short sparse adherent hairs. Scutellum narrow, elongate, triangular, pointed at end; with dense minute punctation.

Elytra bulge, smooth, with parallel sides (female) or narrow slightly posteriorly (male), individually narrowly rounded at apex. Femora reach (female) or do not reach (male) apex of elytra. Hind tarsi shorter (female) or not shorter (male) than tibiae, with 3rd segment insignificantly notched. Body black; antennae black or blackish-brown, sometimes rusty. Elytra rusty-yellow, with black apex, round spot behind middle,

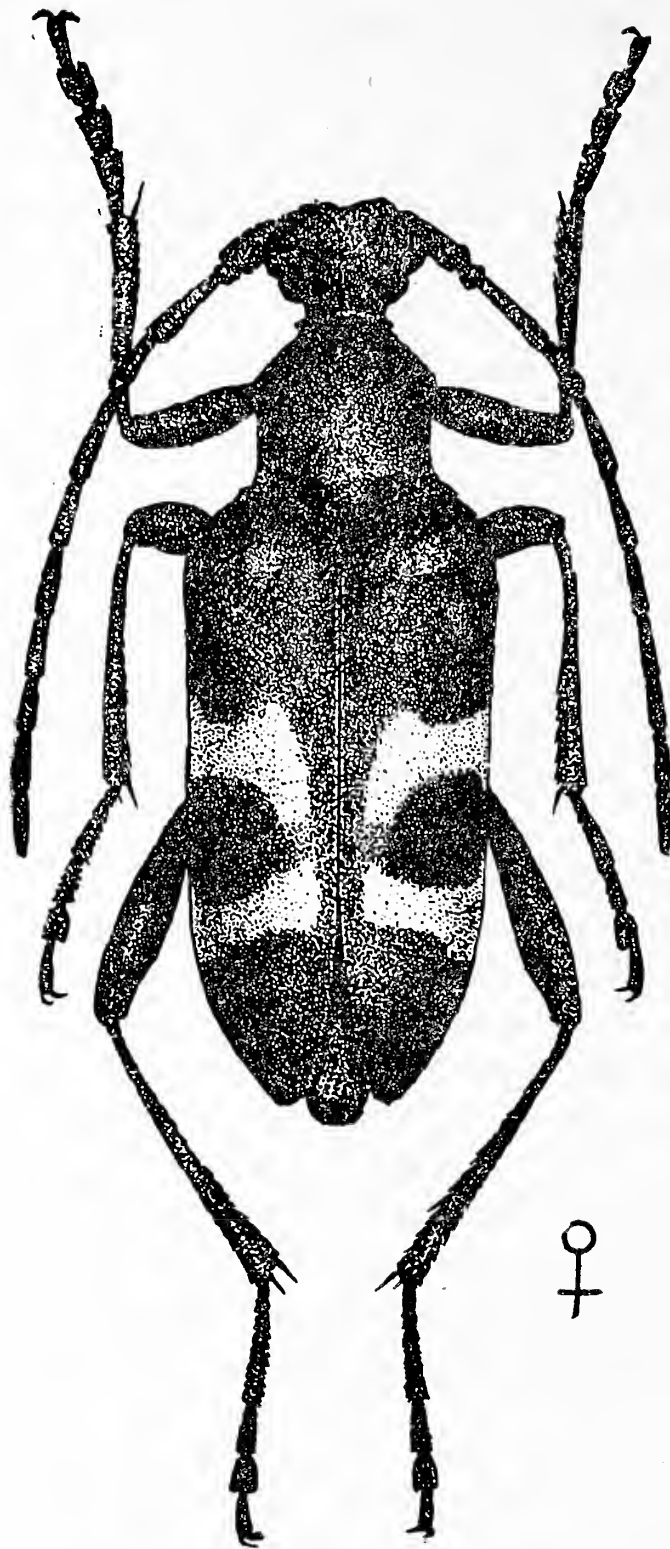


Figure 197. *Judolia longipes* (Gehl.), female.

transverse band anterior to middle, and base. Sometimes black coloration replaced with red so much that elytra become entirely red or, contrarily, entirely black. Length of body 10 to 18 mm.

Egg: White, elongate, almost identically broadly rounded at poles. Chorion with large dense distinct cellular sculpture. Cells five- or six-faceted, spaces between them narrow and silvery. Length of egg 1.8 mm, width 0.5 mm.

Larva (Figure 198): Closer to larva of *Judolia erratica* (Dalm.) in

sclerotization of dorsal locomotory ampullae. Differs in arrangement of hairs on abdominal segment VIII and other features. Head transverse, narrows somewhat anteriorly, slightly retracted into prothorax. Epistoma triangular, broad, medially almost 0.50 its width at anterior margin, with whitish sharply produced frontal sutures laterally, longitudinal brownish suture distinct in posterior half, whitish transverse band anterior to middle, and numerous long hairs. Hypostoma almost flat, narrows slightly anteriorly, with stray setaceous hairs, and white narrow gula medially. Clypeus bulges, white, brownish-rust basally, distinctly trapezoidal, markedly narrows anteriorly, and smooth. Labrum transverse, gently rounded on anterior margin, rusty at base, with long setae. Mandibles elongate, with gentle oblique notch at apex, and more projecting lower denticle.

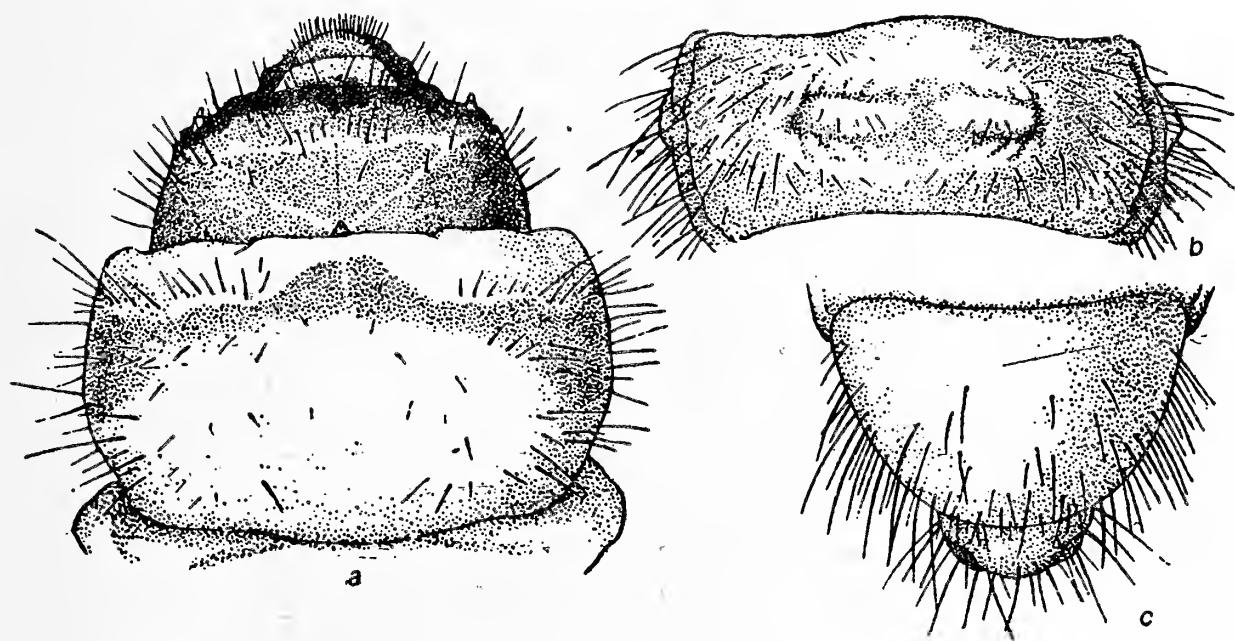


Figure 198. Larva of *Judolia longipes* (Geb.).

a—head and pronotum; b—abdominal tergite with locomotory ampulla;
c—tip of abdomen.

Pronotum transverse, broadens more anteriorly, with short hairs in front of yellow band forming indistinct transverse row, hairs in middle of disk sparse and short, laterally very long and thin. Pronotal shield white, more raised basally, with stray short setae. Prosternum with uniform setaceous hairs. Eusternum bulges, lustrous, slightly sclerotized basally; with very dense hairs, glabrous only in middle of disk. Thoracic legs well developed, anterior clivus between them with small sclerotized spinules. Meso- and metanota in posterior half coriaceous, with numerous hairs laterally; anterior half glabrous, sclerotized, with minute spinules.

Abdomen more or less pubescent (especially on sides); hairs thin,

not very long. Dorsal locomotory ampullae (on abdominal tergites I to VII) convex, with longitudinal groove; faintly sclerotized medial transverse carina convex, with minute spinules, and surrounded by indistinct granules. Ventral locomotory ampullae granulate, with more or less distinct row of granules, and small sclerotized area in middle of posterior half. Abdominal tergite IX in posterior half with long thin dense hairs forming together with those of segment X common densely pubescent field. Tergite VIII in posterior half with long hairs forming transverse band, stray short hairs anterior to middle on disk. Sternite VIII with thin lateral hairs in posterior half and on disk, which almost reach anterior margin. Body white. Head rusty. Transverse rusty or rusty-yellow band laterally and on anterior margin of pronotum interrupted medially by narrow white clearance. Length of body 25 mm, width of head 2.5 mm.

Pupa (Figure 199): Differs from pupa of *Judolia sexmaculata* (L.) in very dense setae on metanotum, and from *Judolia erratica* (Dalm.) in presence of setae on mesonotum in female. Body stocky. Head slightly elongate and short in front of antennae, with small thin hairs on frons around antennal sockets on inner side. Antennae short, flexed to sides, arcuate.

- 319 Pronotum bulges broadly, angularly broadens mediolaterally, markedly narrows anteriorly, with deep narrow flange on anterior margin, bent under at anterior margin and here with setae on protuberant coriaceous tubercles forming dense transverse row narrowly interrupted medially; basally with setae on tubercles forming transverse row interrupted medially by longitudinal groove; numerous coarse setae on disk set on minute tubercles form broad transverse field. Mesonotum with thin setae, five to six on each side. Metanotum with deep median longitudinal groove, tubercularly bulges paramedially in posterior half, with coarse setae on bulges forming two dense tufts.

Abdomen gradually narrows posteriorly. Abdominal tergites convex, with median longitudinal groove, with long thin piliform paramedial setae directed in different ways. Tip of abdomen ventrally obtuse, with pair of small contiguous urogomphi dorsally. Valvifers of female elongate, almost cylindrical, gently rounded at apex. Length of body 13 mm, width of abdomen 4.5 mm. Tip of abdomen densely setaceous.

Material: From Altai, Tuva, Yakutia, Trans-Baikal and Ussuri-Primor'e region. Adult insects 47, larva one, pupa—one female.

Distribution: Northern Asia from Altai to Pacific Ocean coast (northern Sakhalin); from northern Mongolia, northeast China, and North Korea to Yakutia inclusive. Sporadic everywhere.

Biology: Inhabits deciduous forests. Flight of beetles commences from first few days of July and continues through August inclusive.

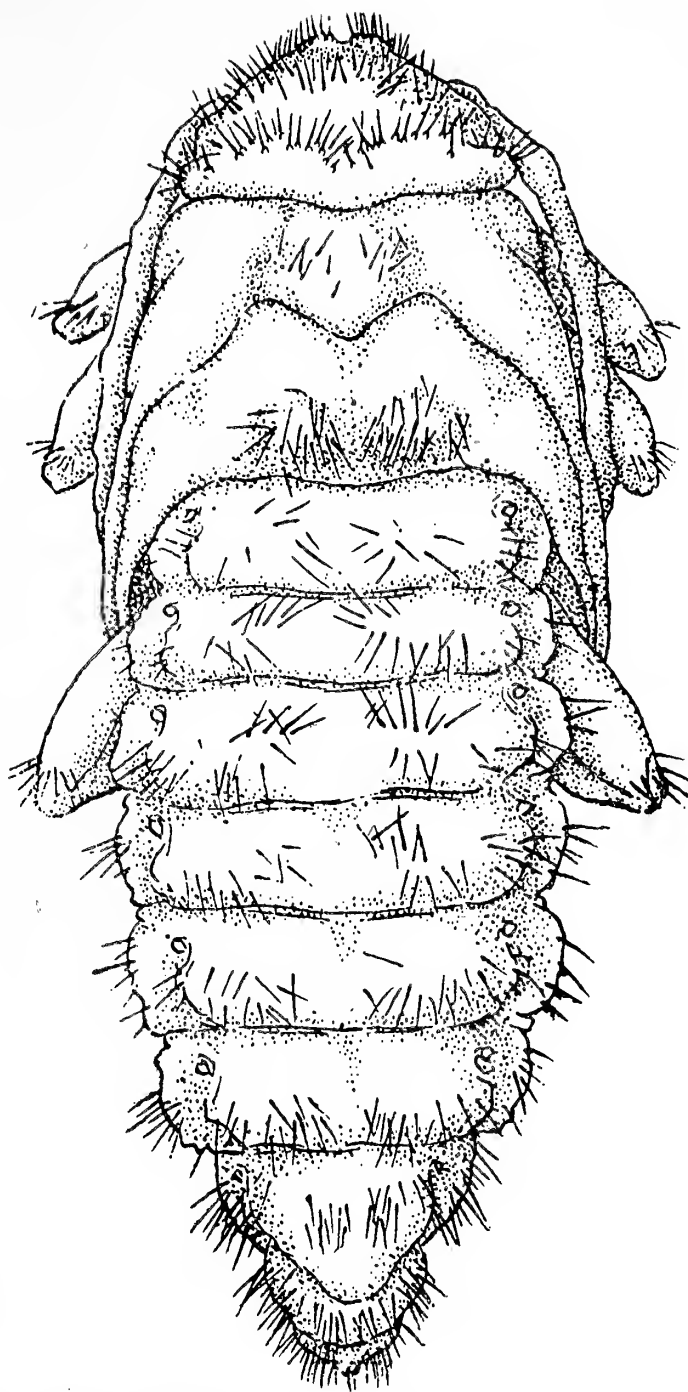


Figure 199. Pupa of *Judolia longipes* (Gebler), female.

Beetles often sighted in second half of July, feed on flowers of Umbelliferae (*Heracleum* and others), mountain ash (*Sorbaria*), meadow-sweet (*Spiraea*), and other plants. Female lays eggs in bark crevices in basal zone of deciduous wood species (sea buckthorn—*Hippophae* and others). Larvae hatch from eggs in August and make galleries initially under bark, then deeper in wood. Galleries longitudinal, meandering, sometimes form platforms up to 18 mm wide, and plugged with frass. Larvae usually live in rotten wood around and in roots. Pupal cell up to 20 mm long and 12 mm wide made at end of gallery in wood and larva pupates in it with its head up. Pupa invariably oriented in cell with ventral side toward trunk surface. It turned by 180°, it rotates vigorously back to its initial position.

Pupation occurs in June and beetles emerge from pupae at end of June, and emerge from wood with developed gonads. Ovaries of one female just emerged from wood contained 252 mature eggs. Another female picked from a flower contained 126 fully developed eggs. Weight of larvae before pupation 273 mg, pupae 252 mg, and beetles emerging from wood 81 to 110 mg. Females generally much larger than males.

5. *Judolia cometes* (Bat.)

Bates, 1884, *J. Linn. Soc. Lond. Zool.*, vol. 28, p. 218 (*Leptura*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 398-399.

Adult (Figure 200): Easily recognized by color of elytra and structure of pronotum. Body comparatively large, broadens at shoulders. Head elongate anterior to antennae, with sharp erect cervix, bulges transversely between antennae, with median longitudinal groove, and dense minute punctation. Temples steeply suspended. Antennae extend markedly beyond middle of elytra (female) or reach their apex (male).

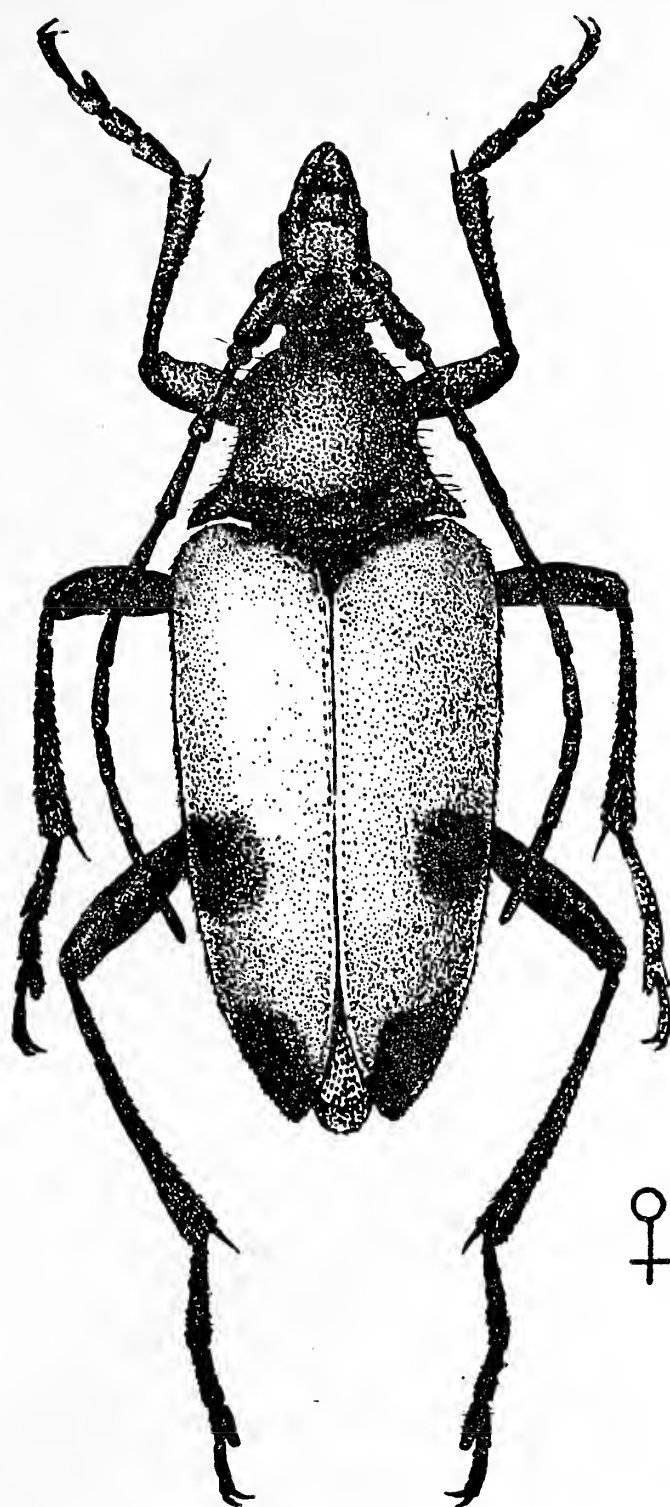
Pronotum campanulate, markedly narrows anteriorly, with produced posterior angles, sometimes angularly broadens anteromedially, with longitudinal carinate protuberance medially on hind clivus; with minute dense punctation and dense brownish or yellowish hairs.

Elytra elongate, distinctly narrow posteriorly (especially in male), individually narrowly rounded at apex, more truncate on inner side; with very small punctation and dense tender light-colored hairs. Body black. Antennae black, sometimes brownish. Elytra straw-yellow, with rounded, slightly transversely elongate black spot behind middle, blackened apex, and black basal margin. Length of body 14 to 22 mm.

Egg: White, with parallel sides, broadly rounded at poles. Chorion almost smooth, with indistinct sculpture. Length 1.5 mm, width 0.5 mm.

Larva (Figure 201): Similar to larva of *Judolia longipes* (Gehl.). Differs in very thick setaceous hairs on abdomen. Head narrows anteriorly, insignificantly retracted into prothorax, with long setaceous hairs in anterior half. Epistoma not impressed, dark brown with lustrous sheen on anterior margin; with transverse whitish band anterior to middle, sometimes band faint. Hypostoma bulges slightly or almost flat, with white longitudinal band in middle and three to four setae laterally. One indistinct ocellus at base of each antenna. Clypeus short, broad, trapezoidal. Labrum transversely oval, markedly narrower than clypeus, with long setae.

Pronotum bulges, rounded laterally, with setaceous hairs anterior to transverse yellow band forming lateral transverse band, erect hairs laterally behind yellow band, and backwardly directed hairs on disk. Pronotal shield lustrous, bulges moderately, white, with sparse setae



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Figure 200. *Judolia cometes* (Bat.), female.

directed backward. Prosternum with sparse setaceous hairs. Eusternum sclerotized basally, coriaceous elsewhere, usually with six setaceous hairs in anterior half.

Abdomen with thick rusty hairs. Dorsal locomotory ampullae with transversely produced sclerotized carina bound by two transverse grooves and sclerotized margin, sometimes with prominent granulation. Abdominal tergite VIII with six to eight hairs anterior to middle forming regular transverse row; numerous hairs form transverse band in posterior half. Tergite IX broadly rounded posteriorly, with dense thick

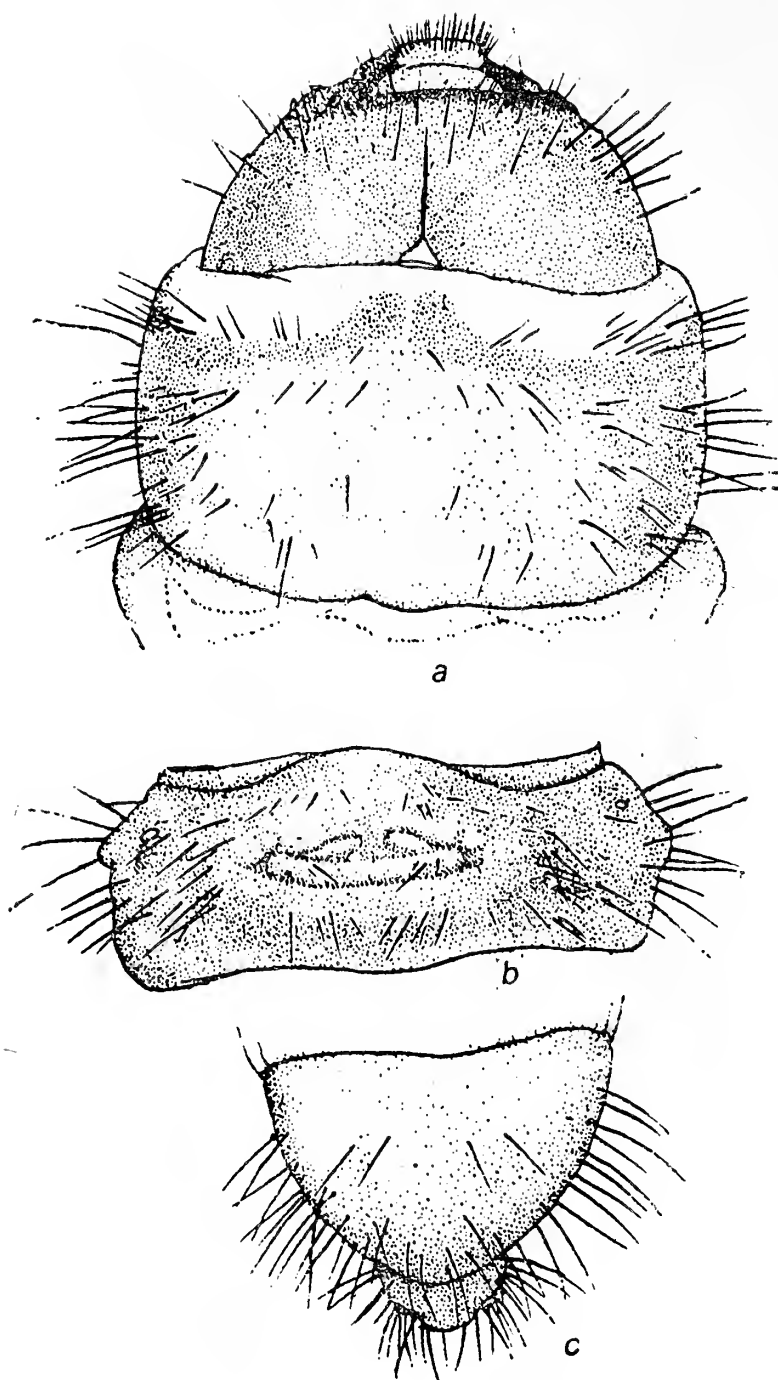


Figure 201. Larva of *Judolia cometes* (Bat.).

a—head and pronotum; b—abdominal tergite with locomotory ampulla;
c—tip of abdomen.

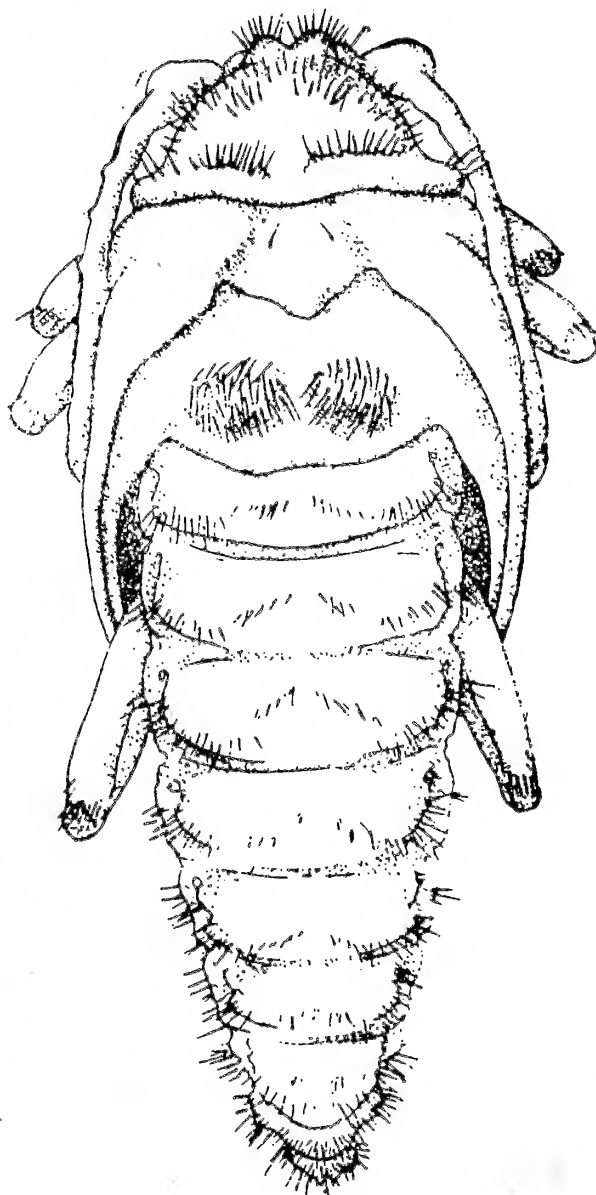
322 rusty hairs along anterior margin, and setaceous hairs of different sizes forming transverse irregular row medially. Ventral locomotory ampullae finely granulate (granules along sides of two transverse rows); on anterior margin with indistinct; on posterior margin distinct transverse sclerotized band, and minute sclerotized spinules in region of longitudinal groove. Sternite VIII on posterior margin with long hairs forming transverse row (short hairs visible among long ones) and stray setae on disk. Sternite IX with six setaceous hairs forming transverse row. Length of body 24 mm, width of head 3.5 mm.

Pupa (Figure 202): Body moderately curved. Head markedly elon-

gate and narrow before antennae, with minute setae behind eyes and at base of antennae. Antennae flexed to sides, bent annularly.

Pronotum bulges, narrows anteriorly, with raised transverse carina on anterior margin covered with setae and interrupted medially. Pronotal disk with fine setae forming broad transverse field. Transverse dense row of setae on posterior margin of pronotum set on protuberant coriaceous base. Mesonotum broad, bulges slightly, glabrous. Metanotum in posterior half with pair of tubercular prominences and covered with dense setae.

Abdomen narrows posteriorly, slightly bent under. Abdominal tergites with median longitudinal groove, and long paramedial setae on small conical coriaceous protuberances forming transverse band interrupted medially. Tip of abdomen dorsally with pair of small urogomphi, obtuse ventrally, and bound laterally by densely pubescent carina. Valvifers of female hemispherical, with laterally produced tubercle. Length 12 to 17 mm, width of abdomen 4.5 to 5.0 mm.



Material: Kunashir. Adult insects 26, larva 54, pupae—two males and three females.

Distribution: Sakhalin, Kunashir; Japan.

Biology: Insular species. Ecologically associated with coniferous vegetation. Beetles sighted from July up to September, maximum in early August. Feed more often on flowers of Umbelliferae and mountain ash and mate there itself when their gonads mature. Females collected on flowers revealed on dissection 52 to 72 mature eggs in the ovaries. Female lays eggs in bark crevices in basal zone of trunks and on roots of decaying and dead fir (*Abies sachalinensis*). Colonizes roots of undergrowth and mature trees.

Larvae live under bark and in upper layer of wood, make longitudinal galleries, and plug them with frass. Usually only one larva seen on undergrowth with thin small trunk. For example, on the undergrowth of five fir trees with a trunk diameter of 4.0 to 6.0 cm, five mature larvae were found. Width of gallery 15 to 22 mm. In June–July mature larvae nibble an oval opening 6.0 mm in width on root surface and emerge onto soil through it. Oval pupal cell made above root or alongside it, sometimes in turf, and larva pupates in it. Length of cell up to 18 mm, width 12 mm.

Pupation occurs in June and first half of July. Pupa lies horizontal in cell with dorsal side up. Young beetles appear in soil in July and early August. Developing beetles emerge on surface within one week. Active emergence of beetles from soil occurs in early August. Weight of larvae 209 to 375 mg, pupae 183 to 341 mg, and beetles 121 to 240 mg.

9. Genus *Judolidia* Plav.

Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 399–400.

Close to the genus *Judolia*, but differs in characteristic features.

Adult: Head shortened. Pronotum elongate, gradually narrows anteriorly (without enlargement in front of middle). Elytra with parallel sides, rounded individually at apex.

Egg: Sides parallel, broadly rounded at poles, with sharp minute cellular sculpture.

Larva: Dorsal ampullae on first six abdominal tergites well developed, sclerotized (as in *Judolia*). Tergite IX produced posteriorly, with brownish spinule.

Pupa: Pronotum with numerous dispersed acicular spinules. Urogomphi at tip of abdomen well developed, widely separated.

This genus consists of a single species.

Type species: *Judolidia znojko* Plavilstshikov, 1936.

1. *Judolidia bangi* (Pic)

Pic, 1901, *Bull. Mus. Paris*, vol. 7, p. 340 (*Leptura*); znojkoï, Plavilstshikov, 1936, *Fauna SSSR*, 21, 1, 400–401; Gressitt, 1951, *Longicorn Beetles of China*, vol. 2, p. 90 (*Anoplodera*).

Adult (Figure 203): Body moderately elongate. Head short in front of antennae, slightly raised between antennae, with median longitudinal suture, sharp cervix behind, and dense, not very prominent punctation. Temples steeply rounded, do not slope and also not rolled, almost erect. Antennae longer than body (male) or apices extend beyond 0.66 length of elytra (female). Fifth segment of antennae equal to 3rd (female) or considerably longer (male). Inner side of eyes gently emarginate.

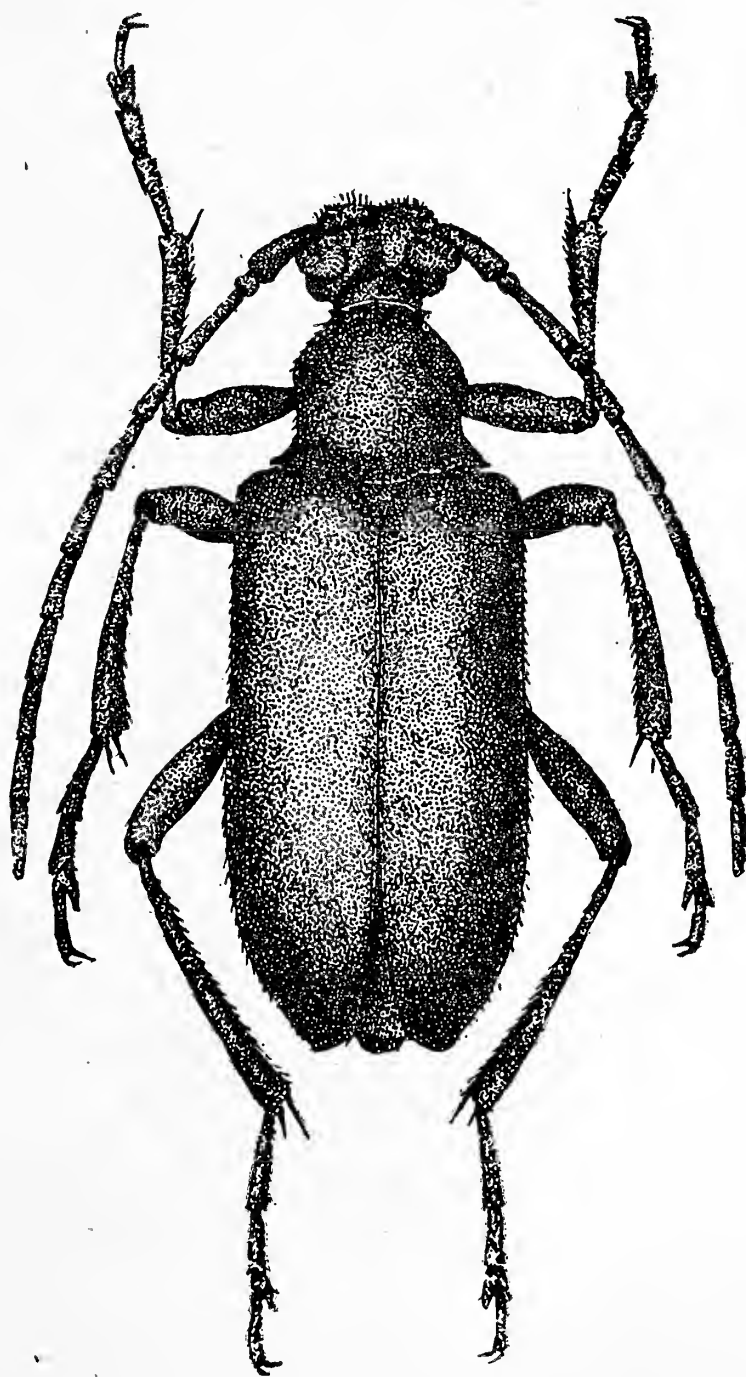


Figure 203. *Judolidia bangi* (Pic)
(= *znojkoï* Plav.), female.

Pronotum elongate, companulate, without protuberances anterior to middle, gradually narrows anteriorly; with dense papilliform round punctation, roundly bulging disk, without perceptible transverse groove posteriorly. Scutellum triangular and elongate, with minute punctation.

Elytra with parallel sides, uniformly bulges on disk, gently rounded and smooth on apex; with dense punctation and minute yellowish hairs directed backward. Legs comparatively long; hind femora considerably short of reaching elytral apices; hind tibiae slightly longer than tarsi. Third segment of hind tarsi bifurcate up to midlength. Body black, elytra black with metallic iridescence. Length of body 11 to 12 mm.

324 *Egg*: White, elongate, obtusely rounded at poles, narrows more at one end. Chorion with minute distinct cellular sculpture; bottom of cells shagreen. Length 1.4 mm, width 0.5 mm.

Larva (Figure 204): Well distinguished by presence of spinule on posterior margin of abdominal segment IX. Head narrowly rounded anteriorly. Frontal sutures indistinct. Epistoma triangular, transversely impressed on disk in anterior half, with well-developed blackish-brown longitudinal suture. Hypostoma bulges, lustrous, 2.5 times wider than its medial length, slightly narrows anteriorly, with four to six short setae forming transverse row. Clypeus 3.0 times wider than long, dark brown basally. Labrum transversely oval, obtuse on anterior margin;

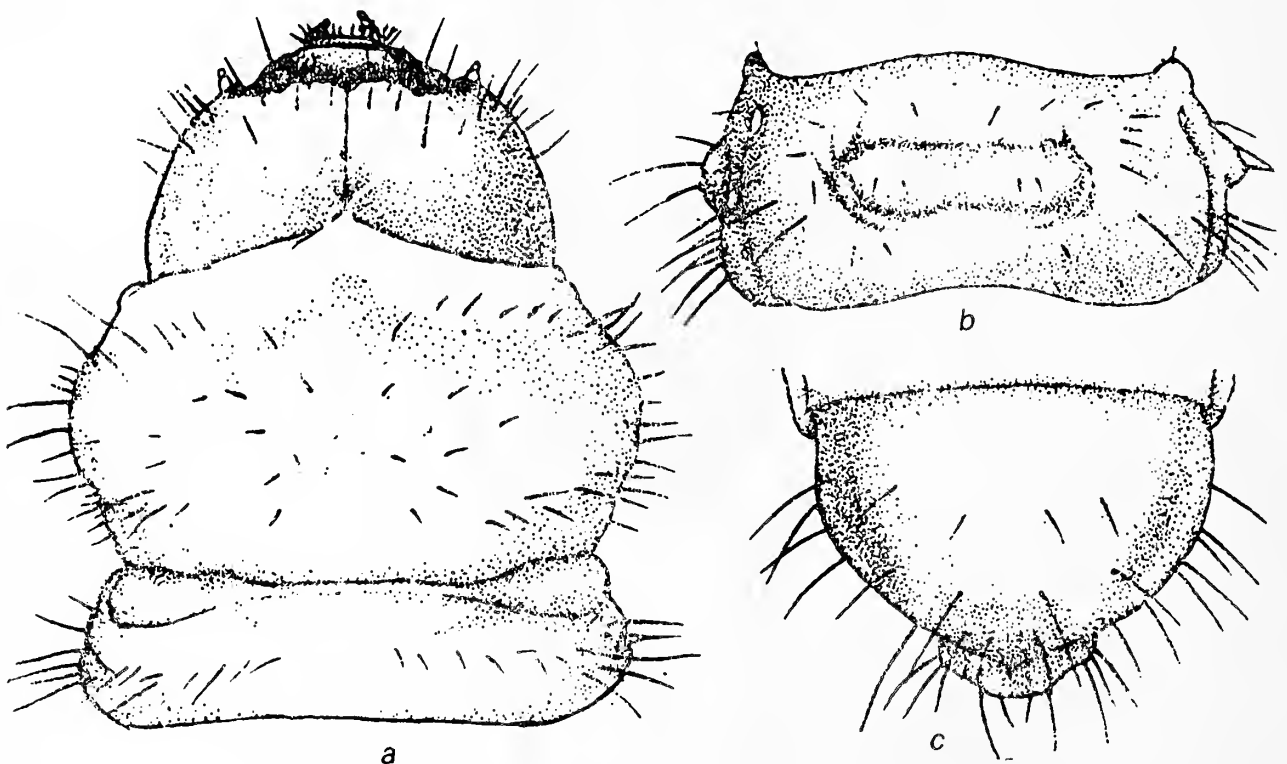


Figure 204. Larva of *Judolidia bangi* (Pic).

a—head and pronotum; b—abdominal tergite with locomotory ampulla;
c—tip of abdomen.

with sparse setae. Mandibles thick, broadly but insignificantly notched, taper, with well-developed projecting denticles, and transverse groove in middle on outer side.

Pronotum angularly produced or rounded laterally, narrows more posteriorly, bulges slightly on disk, with broad white margin in front and behind it, and sparse short setaceous hairs forming indistinct transverse rows. Pronotal shield not bound, without lateral longitudinal folds, fuses with rest of surface. Eusternum bulges, triangular, with three pairs of setae (proximate on anterior margin, more separated anterior to middle and especially at base), sclerotized in posterior half, with minute spinules forming two large lateral spots separated by narrow coriaceous longitudinal band. Propresternum glabrous, coriaceous. Presternum with sparse short setaceous hairs. Thoracic legs slender, comparatively long, with acicular, slightly arcuate claws. Space between legs sclerotized, with minute spinules.

Abdomen with sparse thin lateral hairs and projecting pleural tubercles. Dorsal locomotory ampullae well developed on first six tergites, divided by broad median longitudinal groove and two transverse grooves joining laterally. Carina between these grooves sclerotized, shagreen, with faint setae forming transverse row. Ventral locomotory ampullae well developed on first six sternites and faintly (slightly) discernible on abdominal sternite VII, divided by transverse groove with granules in front and smooth and shagreen behind. Abdominal tergite IX produced at posterior margin, with brownish or dark red spinule. Sternites VIII and IX glabrous, lustrous, with six to eight hairs on posterior margin forming transverse row. Body white; head with rusty-yellow tinge, and black or blackish-brown border on anterior margin of epistoma. Anterior half and sides of pronotum with transverse, very indistinct yellowish band. Length of body 18 to 20 mm, width of head 2.0 to 2.5 mm.

Pupa (Figure 205): Distinguished by acicular spinules on pronotum, and presence of widely separated urogomphi on tip of abdomen. Head bulges between antennae, transversely impressed behind, shortly narrows anteriorly; sides and anterior margin of frons with abundant acicular spinules and well-developed occipital protuberances. Antennae curved annularly, flexed to sides.

Pronotum bulges markedly, narrows in anterior third, with narrow, well-developed or faint median longitudinal groove, and rounded, slightly produced posterior angles; long acicular dispersed spinules on disk, especially in anterior half and laterally, spinules at base forming less (male) or more (female) distinct transverse row, sometimes curved posteriorly in middle (female). Mesonotum glabrous or with stray spinules. Posterior half of metanotum with numerous spinules forming broad field interrupted by narrow clearance medially.

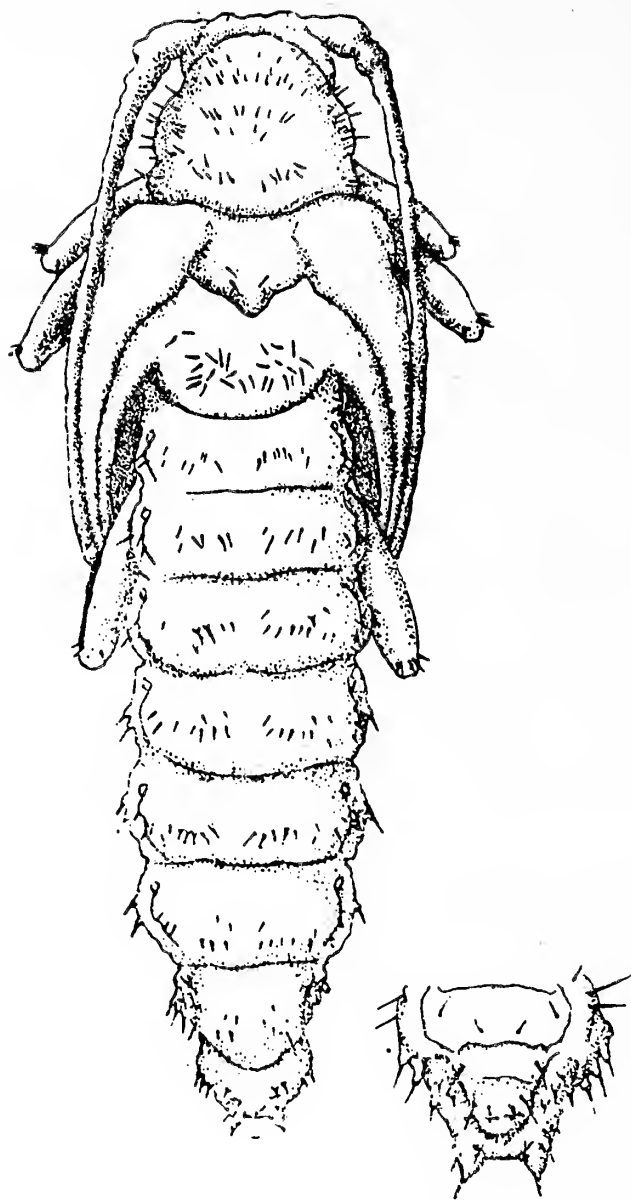


Figure 205. Pupa of *Judolidia bangi* (Pic), male.

Abdomen slightly narrows anteriorly and markedly so posteriorly. Abdominal tergites bulge, with common median longitudinal groove; spinules along sides of groove on protuberant coriaceous base and form uniform (female) or indistinct (male) transverse row. Tip of abdomen obtuse ventrally, bound laterally by horseshoe-shaped carina set with spinules, and dorsally with pair of widely separated urogomphi bearing sharp sclerotized spinule at end. Valvifers of female hemispherical, with laterally produced tubercle at apex. Length 12 to 14 mm.

Material: Ussuri-Primor'e region (Komarovka River). Adult insects 12, larvae nine, pupae—one male and one female. Larval exuviae with beetles and pupae from cells six.

Distribution: Ussuri-Primor'e region (Khankaisk valley, southern Sikhote-Alin', Komarovka River, and Osinovka); Korea, northern China, and Japan.

Biology: Lives in deciduous vegetation. Occurrence sporadic.

Sighted in habitats along river banks and in forests of different densities. Flight of beetles in June and July. Seen on flowers. Female lays eggs in
 326 soil around roots of Maack's honeysuckle (*Lonicera maacka*). Fecundity comparatively high. Ovary of one female found dead in pupal cell contained 116 eggs. Larval hatching commences in last 10 days of July and extends into August. Eggs develop at 20°C for 16 to 19 days. Larvae make galleries initially under root, then in root wood toward trunk, and plug them with frass. Meandering galleries under bark deeply impressed in wood. Mature larva after second hibernation makes cell at end of gallery and pupates in it. Length of cell 17 to 18 mm, width 8.0 mm.

Pupation of larvae commences end of May and ceases in June. Pupae maximum around June 20. Beetles emerge in second half of June and early July. They nibble round holes up to 4.0 to 5.0 mm in diameter on surface of shoots and emerge. Young beetles emerge from wood with developed gonads and are capable of reproducing without supplementary feeding. Weight of larvae before pupation 81.4 to 242.0 mg, pupae 76 to 221 mg, and beetles before emerging from cells 50.8 to 160.0 mg. Weight variation during metamorphosis exemplified in a single insect; larva before pupation weighed 81.4 mg, pupa developed from it 76.0 mg, adult initially 56.4 mg, and five days after emerging from wood 50.8 mg, i.e., weight of insect dropped by 37.9% throughout the period of metamorphosis. Life cycle completed in two years. Population density comparatively high and same tree may be colonized twice. Thus on a honeysuckle root 30 cm long two beetles were found before emerging from cells, and five larvae of second year which pupated only in the following year [*sic*].

This species colonizes roots of decaying and dead shoots of *Lonicera*. Sometimes colonizes them after *Oberea depressa* Gebl. whose larvae live on viable shoots of honeysuckle.

10. Genus *Oedecnema* Thoms.

Thomson, 1857, *Arch. Entom.*, vol. 1, pp. 401–402; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 401–402.

Differs considerably from other genera of the tribe in general habits of adult insects, structure of hind legs in male, and other features.

Adult: Head elongate anteriorly, eyes emarginate on inner side. Antennae shorter than body. Pronotum campanulate, with posterior angles projecting laterally. Elytra narrow posteriorly, notched apically. Hind femora markedly dilated in male, slightly thickened in female; hind tibiae short and curved in male comparatively long and straight in female.

Larva: Characterized by long legs, transverse yellow band on anterior margin of pronotum anteriorly without notch, and dorsal locomotory ampullae with large granules forming three indistinct transverse rows.

Pupa: Tip of abdomen with indistinct urogomphi or without them, abdominal tergites with long setae forming transverse band interrupted medially.

This genus consists of a single species distributed in the Palearctic.

Type species: *Leptura dubia* Fabricius, 1781.

1. *Oedecnema dubia* (F.)

Fabricius, 1781, *Spes. Insect.*, p. 249 (*Leptura*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 401-402; Cherepanov and Cherepanova, 1975, *Zhuki-drovoseki ivovykh lesov Sibiri*, pp. 57-61.

Adult (Figure 206): Beetles readily recognized by round black spots on yellow-rust elytra. Body comparatively stocky, more elongate in male. Head small, elongate, with sharp cervix behind temples. Eyes with small round notch (visible laterally) on inner side. Antennal apices in female reach beyond second pair and in male beyond third pair of black spots on elytra.

Pronotum markedly narrows along anterior margin, with projecting posterior angles, faintly emarginate basally along sides of scutellum, moderately bulges on disk; with dense minute punctation, spaces between them considerably smaller than punctures per se, and with long yellow hairs. Scutellum triangular, with pointed or narrowly rounded apex, with dense minute punctures. Legs moderately developed; hind femora in female insignificantly thickened but in male strongly so, appear swollen. Hind tibiae almost straight in female, curved on inner side in male, with projecting spinescent apex. Abdominal sternite V markedly impressed posterolaterally in female, slightly so in male. Elytra bulge, narrow slightly toward apex in female, markedly so in male, notched apically. Body and antennae black; elytra rusty-yellow, with round black spots, of which three spots disposed triangularly in anterior third, one usually very large spot medially on disk, and one spot in posterior third. Length of body 14 to 18 mm.

Egg: White, smooth, lustrous, slightly curved, and obtusely rounded at poles. Length of egg 1.8 mm, width 0.6 mm.

Larva (Figure 207): Body massive and thick. Head transverse, slightly narrows anteriorly, slightly flattened on top. Epistoma triangular, with pointed apex, broadly impressed in posterior half, bound laterally by distinct white frontal sutures, divided by median longitudinal dark brown suture, well developed in posterior half, and with faint transverse whitish band anterior to middle. Hypostoma bulges slightly,

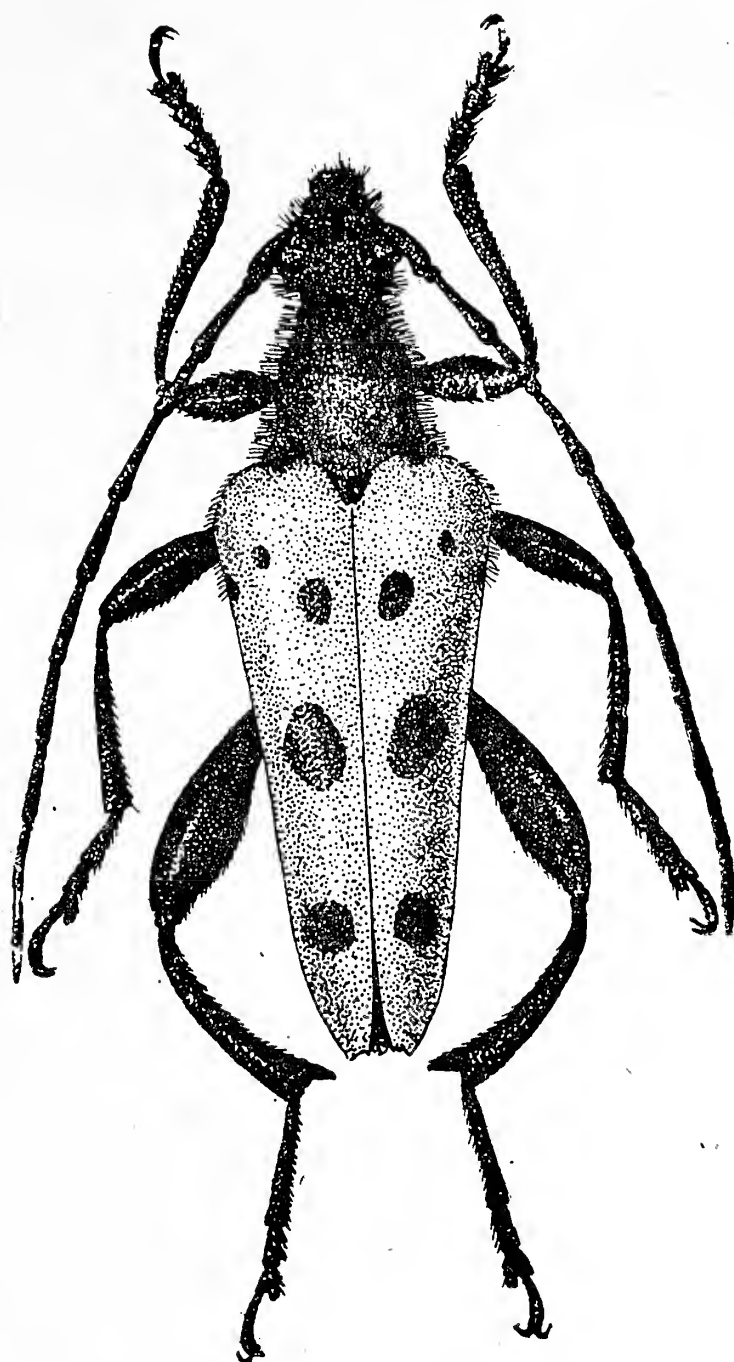


Figure 206. *Oedecnema dubia* (F.), male.

with white median longitudinal band, usually with 10 short paramedial setae. Clypeus broad, lustrous, length 0.33 width at base. Labrum transversely oval, with short setae on anterior margin. Mandibles elongate, obliquely and broadly notched apically, with developed carina on inner side extending from inner anterior angle to upper medial margin.

Pronotum bulges slightly, 2.5 times wider than long, with sparse hairs forming transverse row laterally on anterior margin. Pronotal shield white, with coarse sculpture and indistinct boundaries, without
 328 lateral longitudinal folds. Eusternum coriaceous, with piliform setae, and shagreen narrow band basally. Legs long, claws sharp and curved, well developed, reddish-brown.

Abdomen thick, narrows posteriorly. Dorsal locomotory ampullae

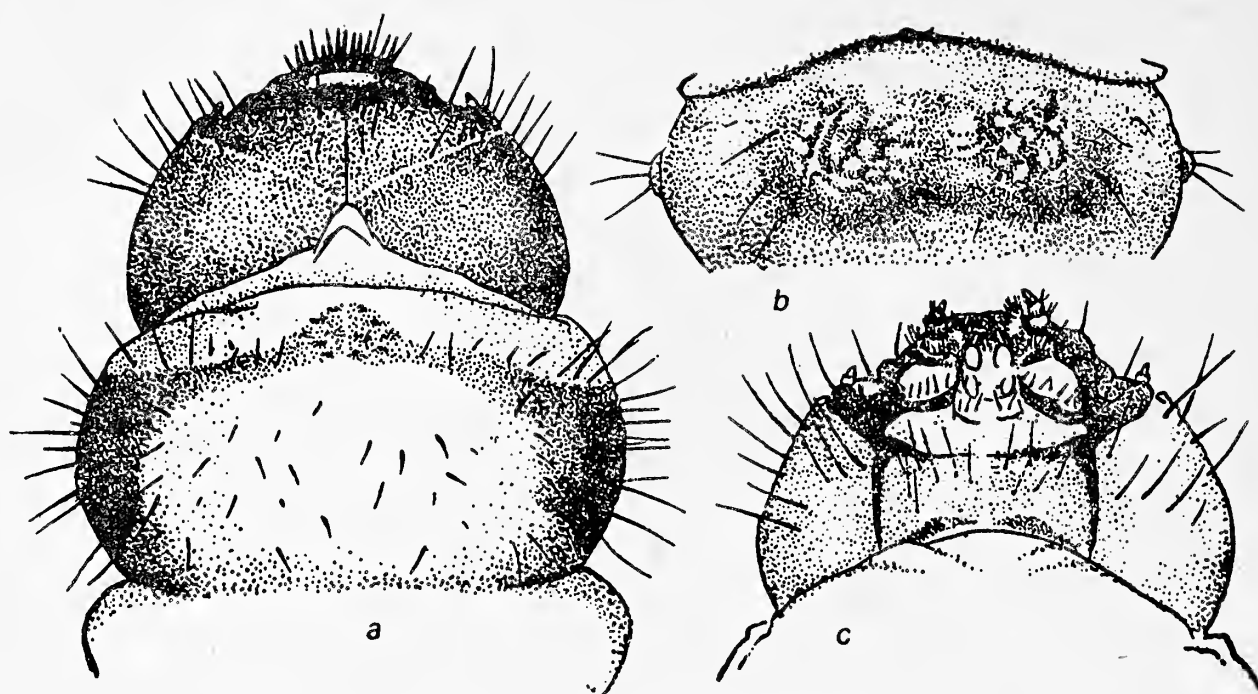


Figure 207. Larva of *Oedecnema dubia* (F.).

a—head and pronotum; b—abdominal tergite with locomotory ampullae;
c—head (ventral view).

bulge, well developed on abdominal tergites I to VI, barely visible on tergite VII, divided by deep longitudinal groove, with large smooth granules forming three transverse rows, and laterally bound by semi-circular fold. Ventral locomotory ampullae with two rows of granules extending obliquely. Abdominal tergite IX transverse, broadly rounded posteriorly, and marginally bound by indistinct carina. Body length of mature larvae 27 to 30 mm, width of head 4.0 to 5.0 mm.

Pupa (Figure 208): Body stocky, curved ventrally. Head elongate, markedly bent under; frons longitudinal and flat, with sparse short setae along margins. Antennae flexed to sides, slightly encircle midfemora dorsally.

Pronotum bulges, with thick sparse setae on anterior margin and especially on disk, and dense setae on posterior margin set on protuberant coriaceous base forming dense transverse row. Mesonotum with stray short setae. Metanotum with large setae forming two dense tufts set on tubercular base. Legs long, femora bent dorsally, with long setae apically forming transverse row. Hind femora in female slender, in male
329 markedly thicken in distal half.

Abdomen thick at base, markedly narrows posteriorly, with apex bent under. Abdominal tergites transverse, bulge, divided by median longitudinal groove; with long piliform paramedial setae forming well-developed tufts or transversely elongate bands. Tip of abdomen obtuse, bound by sparsely pubescent and barely perceptible carina, in female with well-developed valvifers, and dorsally with two acute nonsclero-

tized spinescent urogomphi. Urogomphi sometimes lacking. Length of body 14 to 19 mm, width of abdomen 4.0 mm.

Material: From Altai, Tuva, Ussuri-Primor'e region (Dukhovsk and Partizan), Kamchatka, and Chukchi. Adult insects 726, including 124 raised in the laboratory, larvae 196, pupae—12 males and 14 females.

Distribution: Covers almost the entire Palearctic, from Atlantic to Pacific Ocean coasts. In northern Asia inhabits regions of the Urals, western Siberian lowland, Altai and Tuva, Baikal region, Trans-Baikal, Chukchi, Kamchatka, Ussuri-Primor'e region, Sakhalin, and Kuril' Islands; Japan, Korea, northern China and northern Mongolia. Highly numerous in temperate zone.

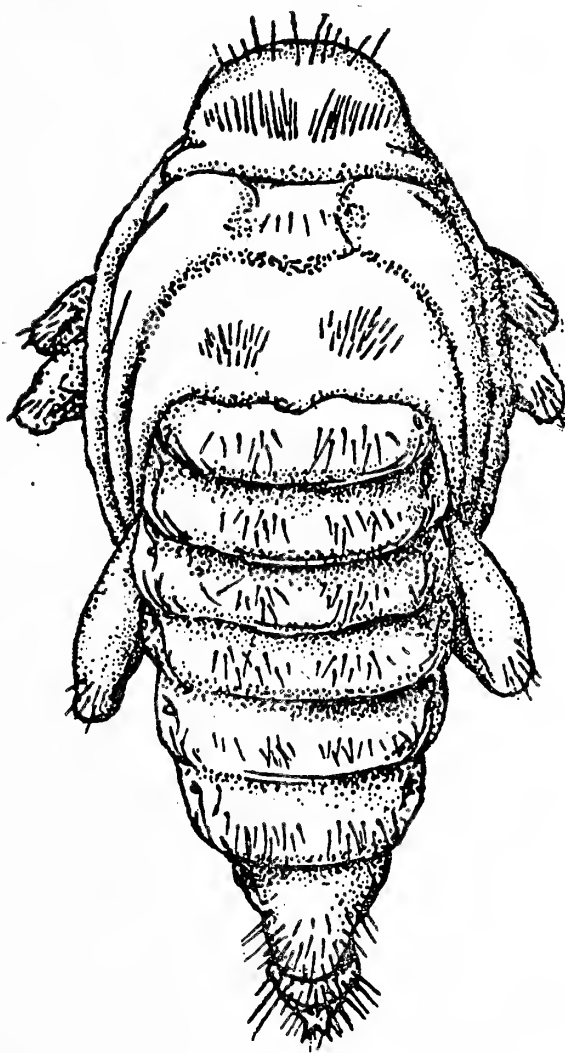


Figure 208. Pupa of *Oedecnema dubia* (F.).

Biology: Lives in deciduous and coniferous forests. Very numerous in mixed vegetation extending in mountains up to height of 2,000 m above sea level. Flight of beetles commences end of May and extends up to first 10 days of August. Over several years 599 beetles were collected in various regions of Siberia and the Far East. Of these, 3.0% were collected in last few days of May, 45.8%—June, 50%—July, and 1.2%—early August. Beetles disappear in mid-August. They are

most active in July and in dry warm weather in June, feeding on various flowers. However, they are capable of reproducing without supplementary feeding. Ovaries of one female dissected five days after emerging from pupal cell contained 124 mature eggs. Female lays eggs in basal zone of dead trees and stumps. Colonizes deciduous and coniferous species of trees. Developmental period of eggs from time of oviposition to hatching of larva, two to three weeks. For example, in Kuzedevsk linden groves 66 eggs were kept under observation at an average daily temperature of 18.9°C. Their embryonic development took 14 to 24 days, average 17.3 days.

Young beetles seen in nature from early July to middle 10 days of August. By mid-August hatching of larvae ceases. Larval hatching maximum in second half of July. Larvae live initially under bark, then in upper layer of wood, where they make longitudinal galleries and plug them with frass. They quite often penetrate thin roots 2.0 to 3.0 cm in diameter. Mature larvae after second or third hibernation prepare pupal cell 18 to 23 mm long, 10 to 12 mm wide, make an oval exit at end of cell, fill it with fibrous frass, and pupate. Pupal cells are usually located in roots exposed to soil. Should the colonized root fall under soil or in contact with it, the larva emerges from it, makes cell 15 mm × 9.0 mm or more in top layer of soil, and pupates in it. Emergence of larvae into soil occurs in autumn and partly in spring at 10.8 to 16.8°C. In the laboratory at 7.0 to 12.0°C larvae moving to the soil entered diapause and only pupated two to three months later.

Pupation in nature commences in May and ceases in June. Pupae maximum in first half of June. Near Lake Telets I studied in detail two birch stumps on May 31. Soil around roots contained three larvae before pupation and 21 pupae, and the root wood 12 larvae of first and
 330 second instars. Pupae normally develop at 10 to 13°C. Total duration of pupal development at this temperature 22 to 28 days, average 24 days. Emergence of beetles from pupae commences end of May and ceases in early July. Weight reduction occurs during metamorphosis. Thus one larva before pupation weighed 217.8 mg, pupa 211.5 mg, and fully formed adult (female) 145.1 mg; these values in another case were respectively 142.0, 137.5, and 109.1 mg. i.e., during metamorphosis the total weight of these insects dropped by almost 29.4%. This reduction was much more in other experiments. Weight of larvae before pupation 69 to 296 mg, pupae 56.5 to 257.0 mg, and adult insects before emerging from pupal cells 41.5 to 193.5 mg. Female considerably larger than male (Table 12). I raised beetles from larvae growing on oak, birch, linden, willow, bird-cherry, fir, and pine. In one instance I found only one beetle in a pupal cell on the root neck (diameter up to 12 cm) of a dead willow tree. In another six larvae were found on the root base of

Table 12. Weight variation in *Oedecnema dubia* (F.)
during metamorphosis (mg)

Sex	No. of insects	Larvae before pupation	Pupae	Young adult insects
Male	16	128.3 (69-184)	104.3 (56.6-152.0)	71.4 (41.5-108.4)
Female	17	171.1 (118.7-296.0)	164.1 (101.1-257.0)	118.9 (77.9-193.5)

Note: Average values outside parentheses, range inside.

a linden stump, and three on another one. In the Far East all roots of an oak stump 20 cm in diameter (half of it turned up from soil) were colonized and contained over 200 larvae. Before pupation some larvae move from root base into thin secondary and tertiary roots, damaging the wood there almost in toto.

11. Genus *Leptura* L.

Linnaeus, 1758, *Syst. Nat.*, 10th ed., p. 397; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 409-410 (*Strangalia*); Serville, 1835, *Ann. Soc. Entom. France*, vol. 40, p. 220; Gressit, 1951, *Longicorn Beetles of China*, vol. 2, p. 92; Kojima and Hayashi, 1969, *Insect Life in Japan*, vol. 1, p. 30.

Adult: Characterized by the following features: pronotum campanulate, usually with acutely produced posterior angles. Sharp flange behind eyes on head. Apices of elytra notched, obtuse, or rounded, or truncated on inner side with elongate outer angle [*Leptura femoralis* (Motsch.)].

Egg: White, elongate, broadly or narrowly rounded at poles; with cellular sculpture comparatively distinct (*Leptura quadrifasciata* L., *L. arcuata* Panz.) or smoothened, visible only at poles [*T. bifasciata* Müll., *L. circaocularis* (Pic)].

Larva: Characterized by granules on dorsal locomotory ampullae forming two transversely elongate elliptical lines uninterrupted medially (in this respect these larvae differ from those of the genus *Anoplodera*).

Pupa: Usually with elongate pronotum and projecting posterior angles. Abdominal tergites with spinules directed backward and setae forming dense tufts only in some species [*Leptura femoralis* (Motsch.)]. Tip of abdomen with pair of developed urogomphi (*Leptura nigripes* Deg., *L. melanura* L.) or without them [*L. circaocularis* (Pic), *L. latipennis* Matsusch.].

This genus is widely distributed in the Holarctic, and partly covers the Ethiopian and Indo-Malayan regions. In northern Asia, very rich
331 in species, the genus is ecologically associated with deciduous and coniferous forests.

ferous forests. All species of the genus *Leptura* develop in dead, quite often rotten wood. This genus and species of the genus *Anoplodera* constitute a common ecological group.

Type species: Leptura quadrifasciata Linnaeus, 1758.

KEY TO SPECIES

Adult Insects

- 1 (26). Apices of elytra notched, obtuse or rounded together, do not taper on inner side.
- 2 (3). Apices of elytra rounded together. 1. ***L. nigripes*** Deg.
- 3 (2). Apices of elytra notched or obtuse.
- 4 (25). Apices of elytra distinctly notched. Antennae black or partly rusty.
- 5 (8). Body short, not longer than 12 mm. Elytra in female red with black pattern.
- 6 (7). Abdomen black. Elytra in female red with black suture and black apex. 2. ***L. melanura*** L.
- 7 (6). Abdomen red. Elytra in female red with transverse black triangular band beyond middle and with black apex. 3. ***L. bifasciata*** Müll.
- 8 (5). Body comparatively large, not less than 25 mm; if less, elytra in female different in color.
- 9 (12). Antennae speckled, with light-colored ringlet at base of segments.
- 10 (11). Posterior half of elytra with black transverse bands. Hind tarsi usually longer than tibiae. 4. ***L. vicaria*** (Bat.).
- 11 (10). Elytra without black bands, only with minute black spot on side behind humeral tubercle or entirely black with rusty smears. 5. ***L. circaocularis*** (Pic).
- 12 (9). Antennae not speckled, without light-colored ringlet at base of segments; black, reddish-rust or dark brown with very light-colored, rusty apex.
- 13 (14). Pronotum basally with broad transverse groove with rounded upright tubercle before it on each side of midline. 6. ***L. regalis*** (Bat.).
- 14 (13). Pronotum basally with narrow transverse groove, without rounded upright tubercle before it.
- 15 (16). Elytra entirely black, or black with red base, or entirely red without transverse bands. 7. ***L. thoracica*** Creutz.
- 16 (15). Elytra red or straw-yellow with transverse black bands, or black with yellow spots; if entirely black or brownish-rust, hind tibiae in male curved.

- 17 (18). Transverse bands on elytra with interceptions, isolated into large spots or sinuate. Hind tibiae in male straight. 8. **L. quadrifasciata** L.
- 18 (17). Transverse bands (if present) on elytra without interceptions, not isolated into large spots. Hind tibiae in male more or less curved.
- 19 (20). Antennae light rust at apex, dark brown at base. Anterior band on elytra arcuately produced anteriorly. 9. **L. arcuata** Panz.
- 20 (19). Antennae black or blackish-brown at apex, uniformly colored from base.
- 332 21 (22). Elytra entirely black or rusty-brown. . . 10. **L. aethiops** Poda.
- 22 (21). Elytra different in color.
- 23 (24). Elytra black with light yellow spots. Antennae and legs entirely black. 11. **L. duodecimguttata** (F.).
- 24 (23). Elytra golden-yellow with transverse black bands. First segment of antennae rusty. Legs completely or partly light-rust. 12. **L. ochraceofasciata** (Motsch.).
- 25 (4). Apices of elytra obtuse. Antennae light yellow. 13. **L. latipennis** Matsusch.
- 26 (1). Apices of elytra taper, with markedly produced outer angle. 14. **L. femoralis** (Motsch.).

Larvae

- 1 (26). Apices of mandibles obliquely emarginate, outer side of culate edge smooth, without longitudinal striation.
- 2 (11). Eusternum coriaceous, not sclerotized, without spinules, and lustrous throughout surface.
- 3 (4). Epistoma in posterior half with two sharp dents diverging anteriorly. Dorsal locomotory ampullae developed on abdominal tergites I to VI; tergite VII smooth, without locomotory ampullae; posterior margin of tergite IX with yellow spot. 1. **L. nigripes** Deg.
- 4 (3). Epistoma in posterior half without sharp dents. Dorsal locomotory ampullae developed on abdominal tergites I to VII; tergite VII with locomotory ampullae in form of transverse fold, with more or less developed granules; posterior margin of tergite IX without yellow spot.
- 5 (8). Three pigmented ocelli on anterior margin of head form small triangle at base of antennae; anterior one bulges more, two posterior ones widely separated and with spotty pigmentation.
- 6 (7). Abdominal tergite IX in anterior half without hairs, with only

- four hairs behind middle forming transverse row. 2. **L. melanura** L.
- 7 (6). Abdominal tergite IX in anterior half with short hairs forming additional transverse row. 3. **L. bifasciata** Müll.
- 8 (5). Three more or less (sometimes spotty) pigmented ocelli on anterior margin of head form transverse band at base of antennae.
- 9 (10). Dorsal locomotory ampullae rounded, slightly elongate transversely; inner rows of granules fuse into common transverse carina 2.0 times wider than anterior row of granules. 4. **L. vicaria** (Bat.).
- 10 (9). Dorsal locomotory ampullae transversely elongate; inner rows of granules fuse into common transverse carina that is not wider than anterior row of granules. 5. **L. circaocularis** (Pic).
- 11 (2). Eusternum partly or entirely sclerotized, with minute spinules imparting matte tone.
- 12 (15). Eusternum not sclerotized throughout its width, with minute spinules along sides of posterior half forming two matte yellowish-brown spots rounded on inner side.
- 13 (14). Epistoma apically with large brown spot extending along sutures in form of three lobes. 6. **L. regalis** (Bat.).
- 333 14 (13). Epistoma without brown spot at apex, monochromatic rust. 7. **L. thoracica** Creutz.
- 15 (12). Eusternum sclerotized throughout its width.
- 16 (25). Eusternum coriaceous anteriorly and posteriorly; middle part sclerotized, with minute spinules forming narrow or broad brownish-yellow transverse band.
- 17 (18). Dorsal locomotory ampullae developed on abdominal tergites I to VI; tergite VII smooth and even, without ampulla. 8. **L. quadrifasciata** L.
- 18 (17). Dorsal locomotory ampullae developed on abdominal tergites I to VII; tergite VII with transverse folded band with more or less distinct granules.
- 19 (24). Eusternum with two to six setae on anterior nonsclerotized coriaceous margin. Anterior margin of locomotory ampulla of abdominal tergite VII with more or less developed transverse field consisting of minute sclerotized spinules.
- 20 (21). Hypostoma with up to 18 setae (hairs). Transverse spinous field on anterior margin of dorsal ampulla of abdominal tergite VII distinct. 9. **L. arcuata** Panz.
- 21 (20). Hypostoma with not more than 14 setae. Transverse spinous field on anterior margin of dorsal ampulla of abdominal tergite VII not distinct.

- 22 (23). Hypostoma with 14 setae. Eusternum with up to four setae anterior to sclerotized field. 10. **L. aethiops** Poda.
- 23 (22). Hypostoma with 12 setae, rarely 14. Eusternum with up to two setae anterior to sclerotized field. 11. **L. duodecimguttata** (F.).
- 24 (19). Eusternum with 10 setae on nonsclerotized coriaceous anterior margin. Anterior margin of locomotory ampulla of abdominal tergite VII without sclerotized field, spinules lacking. 12. **L. ochraceofasciata** (Motsch.).
- 25 (16). Eusternum entirely sclerotized, with minute spinules imparting matte brown tone; only insignificant anterior part coriaceous, not sclerotized. 13. **L. latipennis** Matsusch.
- 26 (1). Apices of mandibles taper, longitudinally striate on outer side of cultrate edge. 14. **L. femoralis** (Motsch.).

Pupae

- 1 (26). Metanotum and abdominal tergites with short spinules.
- 2 (3). Spinules on dorsal surface not large, arranged indistinctly in form of rhombus at base of pronotum. Tip of abdomen usually with pair of proximate urogomphi. . . . 1. **L. nigripes** Deg.
- 3 (2). Spinules on dorsal surface comparatively large, at base of pronotum form transverse band or row interrupted medially, quite often terminally directed slightly forward.
- 4 (7). Body length not more than 12 mm. Spinules on abdominal tergites few, form transverse row (two to three spinules on each side of longitudinal groove).
- 5 (6). Setae at apex and especially on posterior margin of pronotum set on highly produced coriaceous base and form dense transverse row. 2. **L. melanura** L.
- 334 6 (5). Setae at apex and on posterior margin of pronotum without distinctly protuberant coriaceous base, and form comparatively sparse transverse row. 3. **L. bifasciata** Müll.
- 7 (4). Body length not less than 14 mm. Spinules on abdominal tergites numerous, form transverse band, tuft, or transverse row.
- 8 (11). Pronotum on posterior margin with mixed setae of different sizes (thick spinescent and thin acicular) forming dense transverse band interrupted medially.
- 9 (10). Pronotal disk with thick long stray setae. Hind femora apically with three transverse rows of acicular setae, distal ones densest. 4. **L. vicaria** (Bat.).
- 10 (9). Pronotal disk with numerous thin short setae. Hind femora apically with single distal transverse row of acicular setae. 5. **L. circaocularis** (Pic).

- 11 (8). Pronotum on posterior margin with setae of same size (acicular or spinescent) forming transverse row or band interrupted medially.
- 12 (15). Abdominal tergites with numerous spinules in posterior half of each tergite forming two extensive tufts (16 to 20 spinules per tuft along each side of longitudinal groove). Body length not less than 20 mm.
- 13 (14). Spinules on abdominal tergites large, thick, dark brown. Pronotum on anterior margin with thick spinules forming transverse row. 6. **L. regalis** (Bat.).
- 14 (13). Spinules on abdominal tergites not large, light rust. Pronotum on anterior margin with faint thin spinules forming two indistinct sparse tufts. 7. **L. thoracica** Creutz.
- 15 (12). Abdominal tergites with a few spinules in posterior half of each tergite forming transverse row interrupted medially by longitudinal groove (six to eight spinules on each side of groove). If with numerous spinules [*Leptura duodecimguttata* (F.)], body length not over 18 mm.
- 16 (17). Abdominal tergites with numerous spinules forming extensive tuft or transversely extended band along each side of longitudinal groove (16 to 25 spinules in each tuft in male, up to eight in female). 11. **L. duodecimguttata** (F.).
- 17 (16). Abdominal tergites with a few spinules forming transverse row (six to eight spinules on each side of longitudinal groove).
- 18 (21). Frontal tubercles at base of antennae bulge markedly on inner side, with numerous long acicular setae or spinules forming transversely extended tuft (16 to 24 setae in tuft).
- 19 (20). Pronotal disk with numerous short (minute) and much longer spinules forming extensive tuft. Horseshoe-shaped carina at tip of abdomen with two to four spinules on each side. 8. **L. quadrifasciata** L.
- 20 (19). Pronotal disk with sparse setaceous spinules not forming distinct tuft. Horseshoe-shaped carina at tip of abdomen with seven to nine spinules on each side. . . . 9. **L. arcuata** Panz.
- 21 (18). Frontal tubercles at base of antennae bulge moderately on inner side, with a few acicular setae forming indistinct longitudinal row (four to five acicular or spinescent setae).
- 335 22 (23). Pronotal disk with minute sparse setaceous spinules. Body length up to 16 mm. 10. **L. aethiops** Poda.
- 23 (22). Pronotal disk glabrous, without spinules or setae. Body length not less than 18 mm.
- 24 (25). Pronotum on anterior margin with stray spinules not forming tufts. 12. **L. ochraceofasciata** (Motsch.).

- 25 (24). Pronotum on anterior margin with setaceous spinules forming two tufts. 13. *L. latipennis* Matsusch.
 26 (1). Metanotum and abdominal tergites with long acicular setae directed backward. 14. *L. femoralis* (Motsch.).

1. *Leptura nigripes* Deg.

De Geer, 1775, *Mem. Ins.*, vol. 5, p. 136; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 416-418 (*Strangalia*); Krivolutsкая, 1962, *Zool. J.*, 41, 5, 771-772 (*Strangalia*).

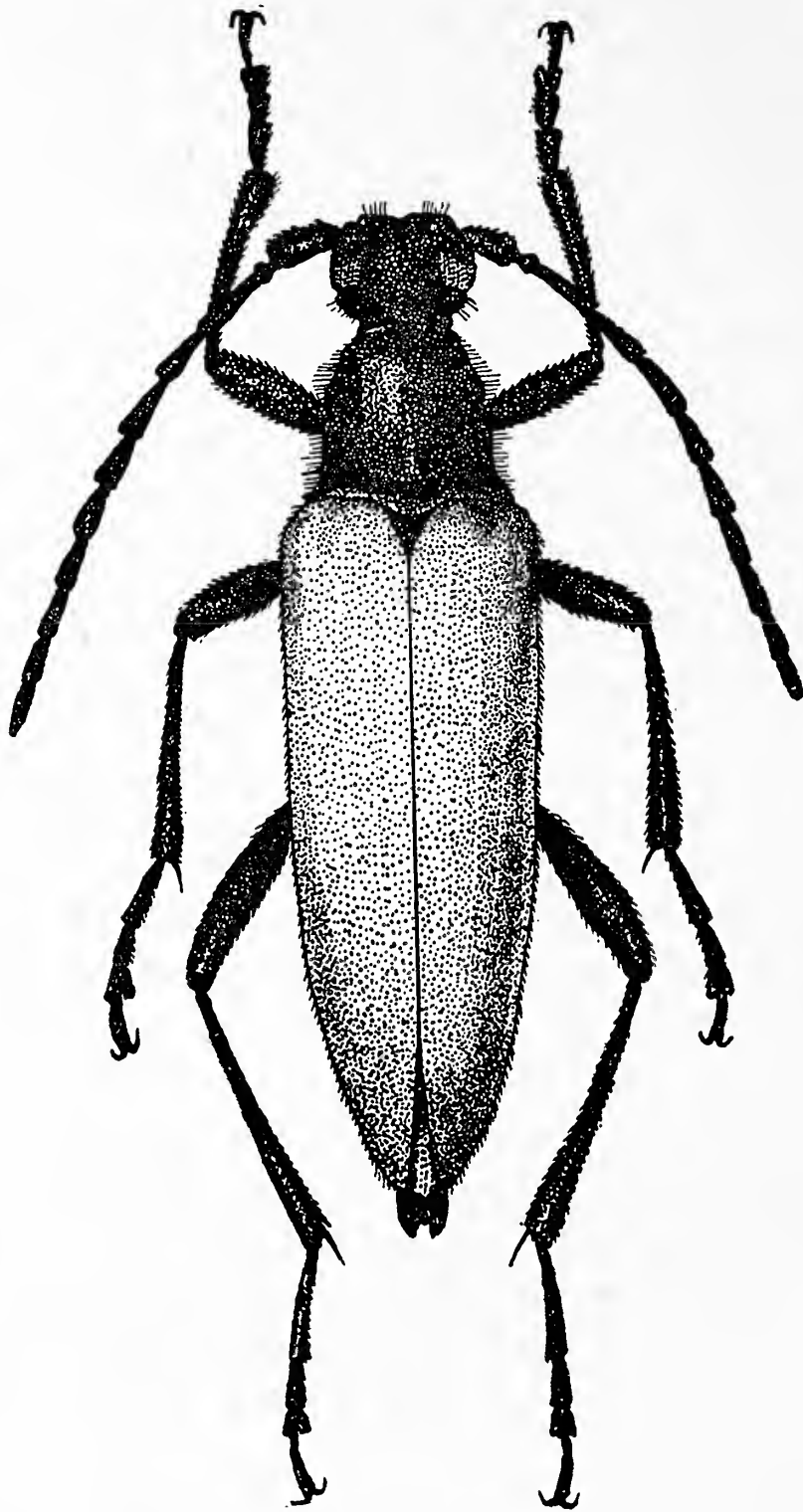
Adult (Figure 209): Body elongate. Head with close punctation and dense erect hairs, and hence appears shaggy. Antennae lustrous at base, matte from apex of 5th segment, with apices extending beyond middle of elytra (male) or not reaching this level (female). First antennal segment thick, with close punctation, not longer than 3rd; apex of 11th pointed. Eyes markedly convex, finely faceted, narrowly emarginate on inner side.

Pronotum slightly elongate, insignificantly narrows anteriorly, with narrow flange on anterior margin, narrow transverse groove at base, and angles produced laterally; with close punctation, erect and sessile, sometimes shaggy, dense light-colored hairs, and usually with smooth narrow median longitudinal band on posterior margin. Scutellum narrow, triangular, pointed posteriorly; with minute close punctation and thin hairs.

Elytra toward apex narrow more in male, less in female, rounded together apically, with straight inner angles, rarely slightly obtuse; with minute comparatively close punctation and short semiadherent hairs. Apex of abdominal sternite V broadly notched, with posterior angles produced, dentiform (male) or only obtuse and sometimes insignificantly emarginate, but not dentiform (female). Body black. Elytra light brown with yellow tinge (f. *typica*) or brownish-red (ssp. *rufipennis* Bless.). Body length 13 to 20 mm.

Egg: White, narrows more toward one pole, papilliform, and slightly pointed; obtusely rounded at the other pole. Chorion with flat cellular sculpture. Cells five- or six-faceted, with narrow septa. Length 2.1 mm, width 0.5 mm.

Larva (Figure 210): Characterized by dorsal locomotory ampullae on first six abdominal segments, with yellow spot at posterior margin of tergite IX. Head transverse, narrowly rounded anteriorly, with hyaline ocellus laterally at antennae, and edged with faint transverse groove at base extending from apex of hypostoma parallel to anterior margin of pronotum. Epistoma broad, triangular, with two dents diverging anteriorly in posterior half, and numerous piliform setae in anterior half. Frontal sutures well developed, straight; longitudinal suture of



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Figure 209. *Leptura nigripes* Deg., female.

hypostoma brownish, sometimes appears obliterated and indistinct in anterior half. Hypostoma flat or bulges slightly, insignificantly narrows anteriorly, with straight lateral sutures, white, quite often faint, longitudinal gula medially, with eight dispersed setae along sides of gula. Clypeus narrows anteriorly, hyaline, rusty at base. Labrum broadly rounded on anterior margin, with dense setae. Mandibles notched apically, with markedly produced lower and short upper denticle, and transverse girdlelike prominence in middle on outer side.

Pronotum 2.0 times wider than long, with broad transverse yellow

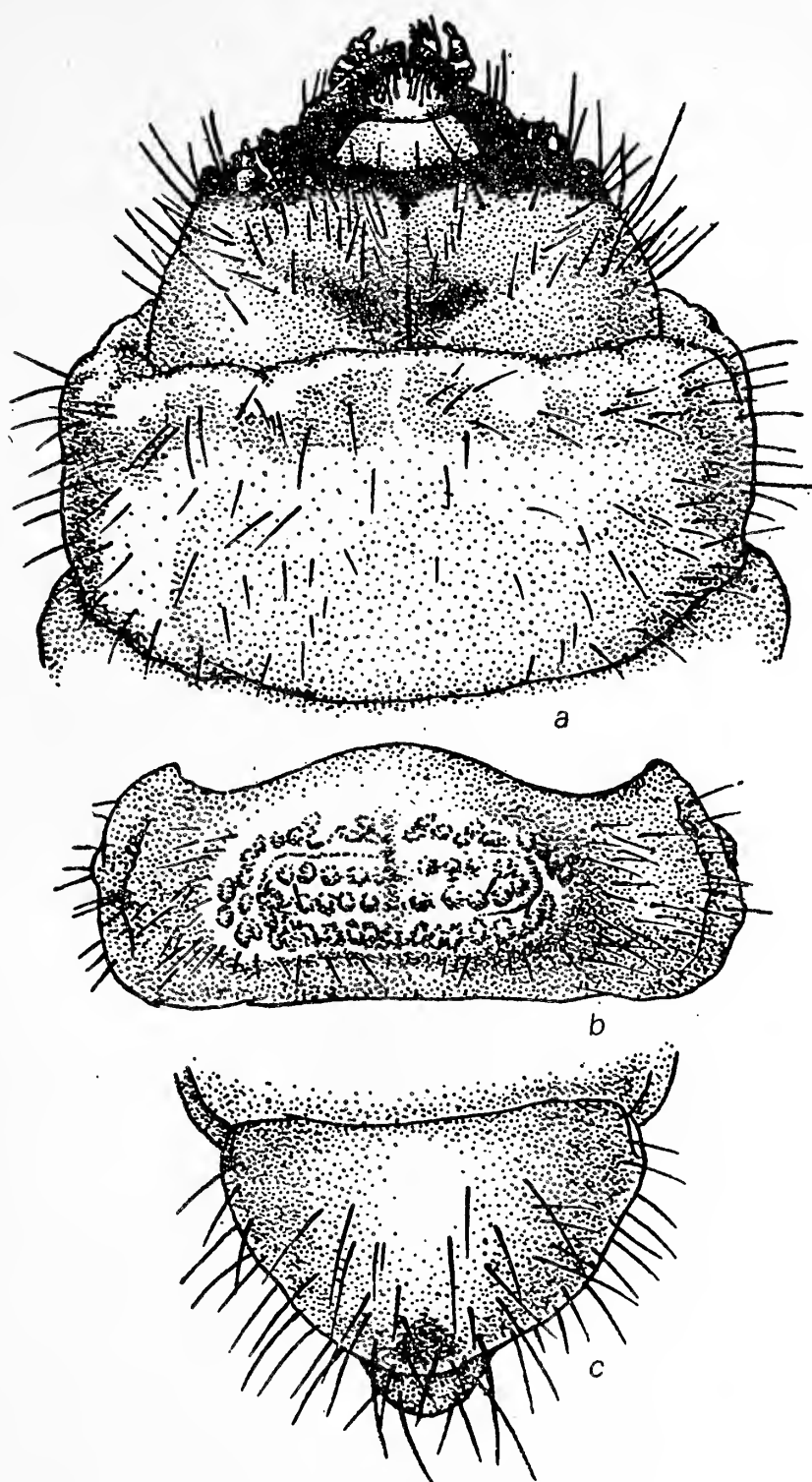


Figure 210. Larva of *Leptura nigripes* Deg.

a—head and pronotum; b—abdominal tergite with locomotory ampulla;
c—tip of abdomen.

band in anterior third (with two deep notches laterally on anterior margin and narrow white interception in middle); setaceous hairs on sides numerous, on disk sparse and scattered. Pronotal shield bulges slightly, more distinct and perceptibly striate in mature larvae. Eusternum coriaceous, with short setaceous hairs laterally. Anterior half of meso- and metanota sclerotized, with dense minute spinules forming two brownish
337 transverse shagreen bands.

Abdomen laterally with sparse short hairs. Dorsal locomotory ampullae disposed on first six abdominal tergites, with granules forming two transversely elongate ellipses, and four short setae on each side of longitudinal groove between rows of granules of inner ellipse. Ventral locomotory ampullae with two distinct transverse rows of granules, well developed on I to VI and faintly, sometimes barely perceptible or nearly invisible (especially in I-instar larvae) on sternite VII. Posterior margin of abdominal tergite IX with yellowish spot, glabrous anteriorly, elsewhere with long thin hairs. Body length of mature larvae 27 to 30 mm, width of head 3.5 to 4.0 mm.

Pupa (Figure 211): Body elongate. Head considerably narrower than

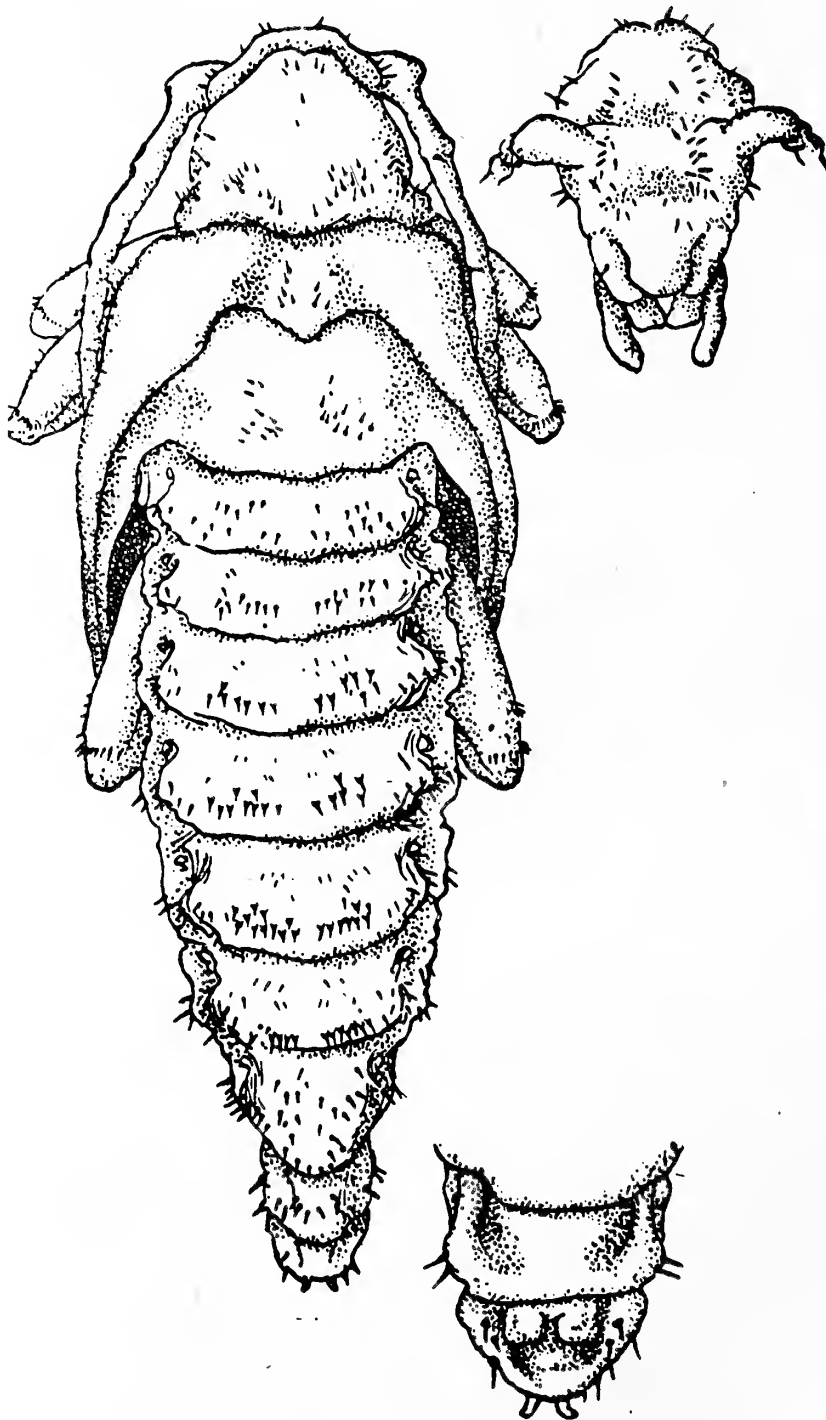


Figure 211. Pupa of *Leptura nigripes* Deg., female.

pronotum, shortened anterior to antennae. Frontal tubercles at antennal bases with numerous spinules forming two longitudinally elongate tufts. Anterior margin of frons with spinules forming transverse row that curves forward slightly. Antennae short, arcuate.

Pronotum elongate, narrows anteriorly, bulges on disk, with pointed or rounded posterior angles; with sharp spinules laterally and in anterior half, basally forming two tufts that diverge from middle of base laterally. Meso- and metanota with short acute spinules forming two small and large tufts respectively.

Abdomen with parallel sides, narrows from segment V posteriorly. Abdominal tergites bulge, with median longitudinal groove and rather large sharp spinules in posterior half that, lateral to this groove, form transversely extended tuft, and dispersed or transverse band of minute spinules in anterior half. Tip of abdomen (dorsal view) rounded and with large spinules (female), or slightly elongate with two large urogomphi, each bearing sclerotized spinule (male). Valvifers in female hemispherical, laterally produced at apex, and sclerotized here. Body length 18 to 21 mm, width of abdomen 4.0 to 5.0 mm.

338 *Material:* From Ob' region forests, Altai, and Tuva. Collected in nature and raised in the laboratory; adult insects 543, including 165 beetles raised in the laboratory, larvae 97, pupae—six males and four females.

Distribution: From Atlantic to Pacific Ocean coasts; quite common within forest and forest-steppe zones. In northern Asia—the Urals, eastern Ural region, western Siberian lowland, including Barabinsk and Kulundinsk forest-steppes, Altai, Tuva, Minusinsk and Abakansk forest-steppes, Yakutia, Baidal region, Trans-Baikal, Ussuri-Primor'e region and Kamchatka. Northern Mongolia.

Biology: Inhabits deciduous and mixed forests. Highly numerous in birch forests in foothills and plains of western Siberia. Flight of beetles commences end of May and extends almost up to mid-August. Beetles maximum in July. For example, of 366 beetles collected systematically in different regions, 1.1% were collected end of May, 14.2%—June, 79.3%—July, and 5.4%—August. Beetles quite often seen on flowers of Rosaceae (*Spiraea*, *Filipendula*), Umbelliferae (*Heracleum*, *Angelica*), Compositae (*Archillea*, *Matricaria*), and other plants. Here they gather pollen, mate, and female then flies to a tree to oviposit. Fecundity of beetles high. Ovaries of one female one week after emerging from wood contained 184 mature eggs, of another, 174. Dead birch and aspen in which wood has decayed colonized. Eggs laid in wood fissures of trunks, thin branches, and decaying stumps. In 1968 development of eggs took 16 to 24 days, average 18.5 days, in a gently sloping forest in Salair. Hatching of larvae commences in July and ceases in August.

On hatching larvae bore into wood, make longitudinal galleries there, and plug them densely with frass. Mature larva after third hibernation makes pupal cell in wood oblique to or across trunk and pupates in it with its head toward surface. Width of gallery before cell up to 10 mm. Sometimes larval galleries parallel and merge into wide niches. Length of cell 20 to 22 mm, width 7.0 to 8.0 mm.

Pupation usually commences mid-May and ends in June. Pupae maximum mid-June. Pupal development at room temperature completed in two to three weeks, in the laboratory, on the average, in 18.2 days. Developing beetles nibble round opening 4.0 to 7.0 mm in diameter on trunk surface and abandon cell through it. Emergence of beetles from wood commences end of May and ceases in July. Weight of larvae before pupation 171.0 to 326.7 mg, pupae 156 to 297 mg, and beetles 92 to 252 mg. Weight variation during metamorphosis exemplified by four insects (females) raised in the laboratory. Total weight of larvae before pupation 990 mg (100%), pupae 929.5 mg (93%), and adult insects 660.5 mg (66.1%). Population density comparatively quite high. For example, 14 beetles emerged from a birch shoot 12 cm in diameter and 26 cm long. Thin shoots (up to 3.0 cm in diameter) and thick trunks (up to 20 cm or more in diameter) colonized.

2. *Leptura melanura* L.

Linnaeus, 1758, *Syst. Nat.*, 10th ed., p. 397; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 438-440 (*Strangalia*); Duffy, 1953, *Monograph. Immat. Stages of Brit. and Imp. Timb. Beetles*, pp. 138-140 (*Strangalia*).

Adult (Figure 212): Distinguished by small body and (in female) 339 elytra with darkened apex. Head with raised frontal tubercles at antennal base, median longitudinal suture, gently rounded on occiput, and with large deep punctures (distance between them not less or only slightly less than punctures per se). Antennae long, extend beyond 0.66 length of elytra (female) or almost reach their apices (male). Fifth antennal segment considerably shorter than 3rd, distinctly longer than 4th.

Pronotum with parallel sides in posterior half, narrowly rounded in anterior third, uniformly bulges on disk, with narrowly bent anterior margin (without broad flange here), faintly impressed transversely at base, and posterior angles produced laterally, subulate; with large dense deep punctation and minute or much longer light-colored adherent hairs. Scutellum elongate, pointed apically, with short adherent hairs.

Elytra comparatively broad, with parallel sides (female) or elongate, narrowing gradually from base to apex (male); with deep punctation and semiadherent black or light-colored hairs; notched apically with insignificantly produced, sometimes almost rounded angles. Body,

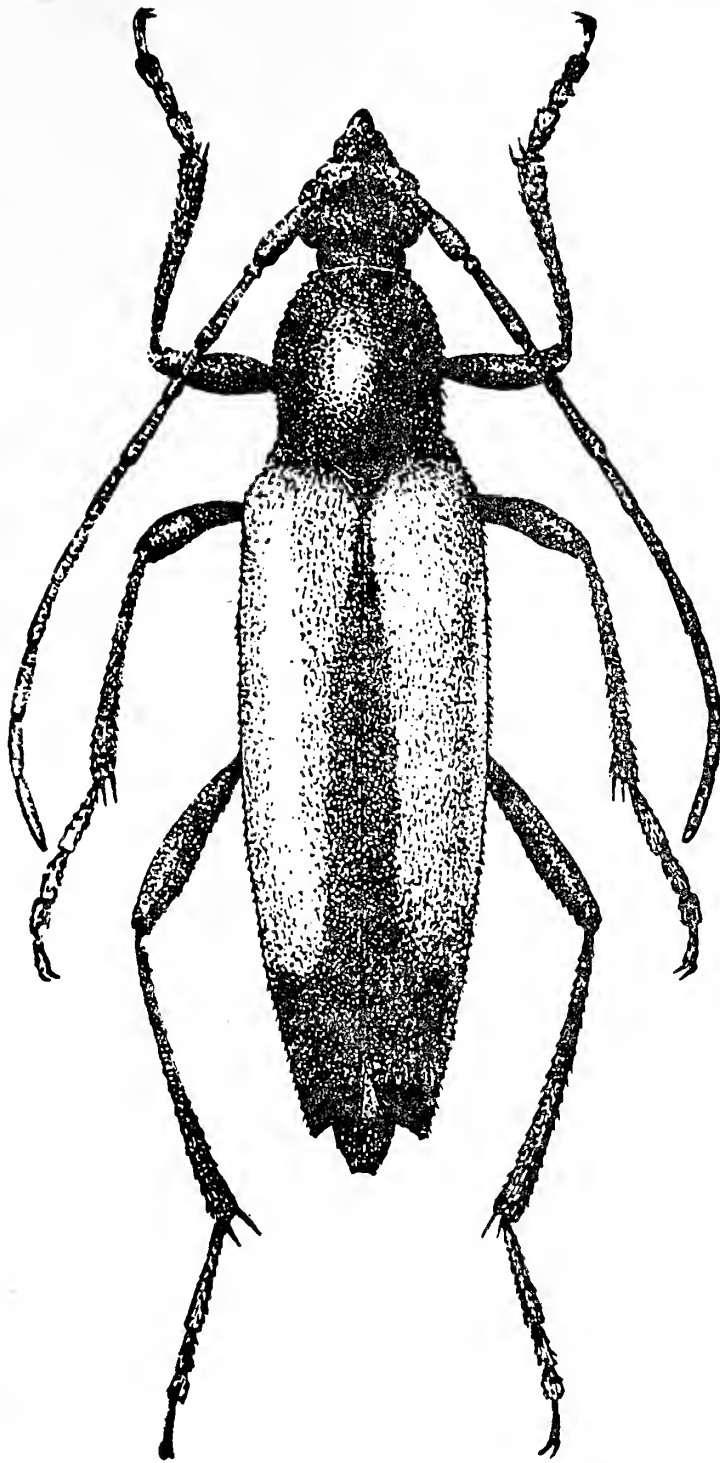


Figure 212. *Leptura melanura* L., female.

antennae, scutellum, and legs black; elytra brownish-yellow or red, with insignificantly blackened suture and blackened apex (male) or broad black band on suture (female) broadening toward apex (f. *typica*). Sometimes elytra monochromatic, yellowish-red, tibiae reddish-rust (ab. *georgiana* Pic); rarely elytra entirely black (ab. *corvina* Plav.). Length of body 6.0 to 10.0 mm.

Egg: White, elongate, narrows slightly toward both ends, gently rounded at anterior and posterior poles. Chorion smooth, with noticeable finely cellular sculpture only at ends. Length 1.5 mm, width 0.5 mm.

Larva (Figure 213): Characterized by presence of locomotory ampullae on abdominal segments I to VII and absence of sclerotization on eusternum. Head with parallel sides or slightly narrows anteriorly, with sparse long hairs laterally in anterior half, single pigmented black ocellus ventral to antennae, sometimes two additional spottily pigmented ocelli visible, which recede posteriorly along triangle. Epistoma flat, pointed apically, reddish-brown on anterior margin, with median longitudinal brownish suture continuous or interrupted in anterior half, and distinct straight or slightly curved frontal sutures laterally. Hypostoma bulges slightly, almost flat, slightly narrows anteriorly, with four large setae forming transverse row on anterior margin, additionally with one to two setae forming second transverse row along sides receding posteriorly, and longitudinal white band in middle. Clypeus broad, 3.0 times wider than long, slightly narrows anteriorly, brownish basally. Labrum transversely oval, laterally rounded, obtuse or straightly truncate at anterior margin; with sparse setae, glabrous on disk, and with long setae basally forming transverse row. Mandibles thick, reddish-brown, broadly notched apically, with markedly elongate lower denticle.

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Pronotum laterally and on disk with sparse (stray) setaceous hairs, transverse yellow band laterally in anterior half with indistinct notches. Pronotal shield bulges slightly, white, merges with rest of surface. Prosternum with sparse setaceous hairs. Eusternum bulges, coriaceous; with three setae laterally, anterior and posterior ones long, middle one short. Meso- and metanota shagreen, slightly sclerotized.

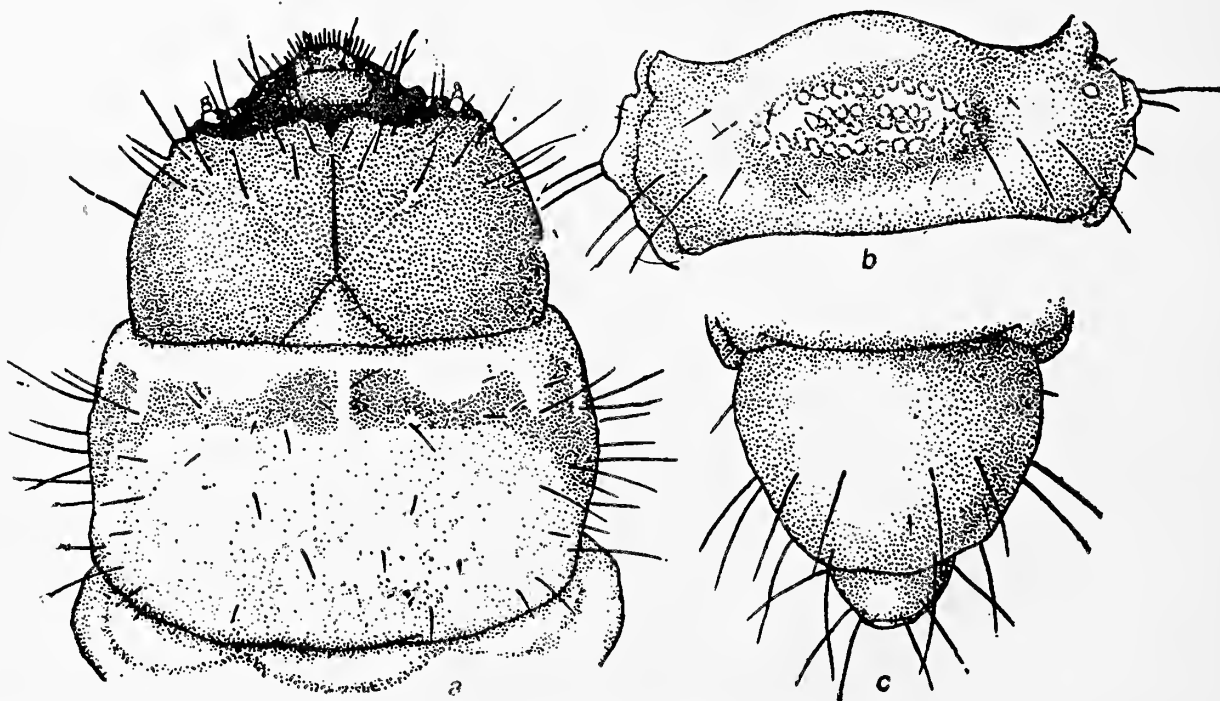
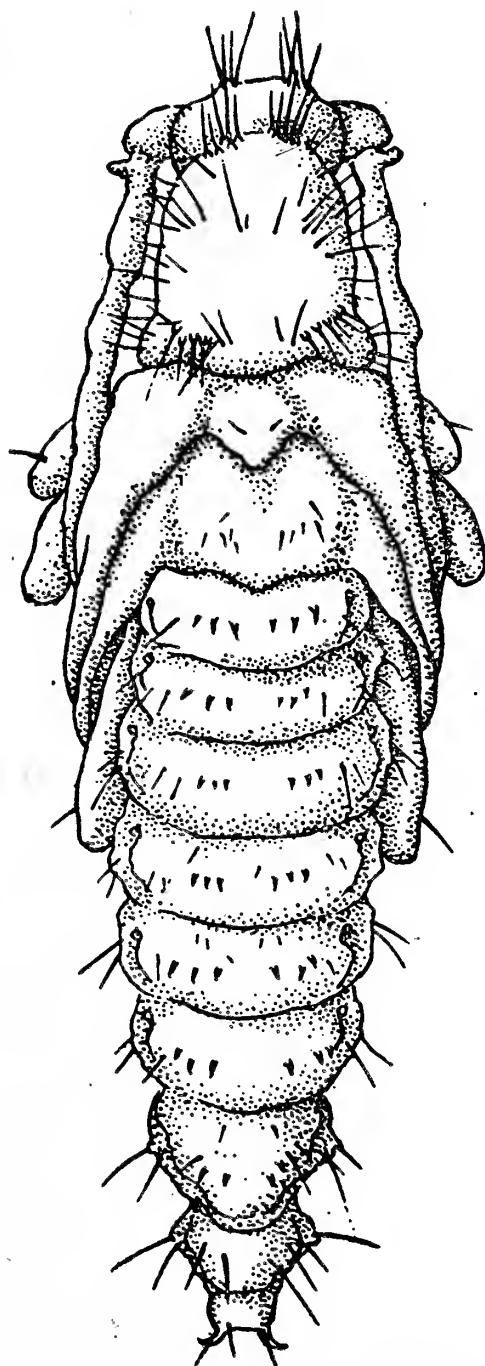


Figure 213. Larva of *Leptura melanura* L.

a—head and pronotum; b—abdominal tergite with locomotory ampulla;
c—tip of abdomen.

Abdomen laterally with sparse thin hairs. Dorsal locomotory ampullae well developed on abdominal tergites I to VI, with minute granules forming two transversely elongate ellipses. Locomotory ampulla on tergite VII in form of transverse groove bordered by faint granules. Ventral locomotory ampullae on abdominal sternites I to VII with rather small granules forming two distinct or indistinct transverse rows. Abdominal tergite IX broadly rounded at posterior margin, glabrous in front, with four long hairs behind middle forming transverse row. Body length of mature larvae 14 mm, width of head 2.0 mm.

Pupa (Figure 214): Recognized by urogomphi on tip of abdomen and arrangement of spinules. Body elongate. Long setae on occipital protuberances of head behind eyes, three long thick setae at antennal



bases along sides of frons, and four thin setae forming transverse row on anterior margin at base of clypeus. Antennae flexed to sides, curved
 341 annularly in distal half. Apex of 1st antennal segment projects outward, spinescent.

Pronotum elongate, narrows anteriorly, with smooth bulging disk, faint longitudinal groove, and conically produced posterior angles; 10 thick setae on posterior margin set on protuberant coriaceous base form dense transverse row widely interrupted medially, five thin setae on each side of median line on anterior margin set on protuberant coriaceous base form two transverse rows or two bands separated by small interception, and sparse thin setae laterally. Mesonotum bulges, glabrous, with single spinule only along sides of posterior half. Metanotum bulges slightly, with faint flat median longitudinal groove in anterior half, and five spinules forming one tuft on each side in posterior half.

Abdomen gradually narrows posteriorly. Abdominal tergites bulge in posterior half, with median longitudinal groove, three identical long spinules along each side of groove forming transverse row, and one or two setae lateral to groove. Tip of abdomen with two widely separated urogomphi set with sclerotized terminal spinule bent laterally, falcate. Apical sternites of abdomen with stray thin setae along sides. Body length 10 mm, width of abdomen 3.0 mm.

Material: Collected in Upper Ob' region, Altai, Salair, and Tuva. Adult insects over 2,600, larvae 54, and pupae—one male and one female.

Distribution: From Atlantic to Trans-Baikal inclusive. Northern Asia—the Urals, western Siberian lowland, northern Kazakhstan, Altai, Tuva, Baikal region, and Trans-Baikal. Northern Mongolia.

Biology: Inhabits forest-steppe and forest zones. Found in mountain forest belt, but does not extend upward beyond 1,000 m above sea level. For example, in forests on the Kyga River (falls in Lake Telets) at a height of 400 to 500 m, this species was sighted in large numbers; in Ayukol' area 2.5 km away from Kyga at a height of 1,000 m not seen even though wood species (birch and others) necessary for its development available there. It is highly numerous in forests of the plains of southern Ob' region, Salair, foothill regions of Altai, and southern taiga zone. Flight of beetles commences early June and ends in first few days of September. Over several years 2,605 beetles were collected from many regions of western Siberia. Of these, 1.4% were found in first half of June, 4.2%—second half of June, 40.2%—first half of July, 32.9%—second half of July, 18.2%—first half of August, 2.6%—second half of August, and 0.5%—early September. En masse flight observed in July in all regions. Beetles often seen on flowers of Umbelliferae, Compositae, Rosaceae, and other plants. They fly from

these plants to trunks of wood species where female oviposits in bark
 342 crevices and wood fissures in basal zone of trunk. This species prefers
 birch, aspen, and bird-cherry. Often found on undergrowth. Fecundity
 of female comparatively high. Ovaries of one female picked from a
 flower contained 40 eggs. Embryonic development from time of oviposi-
 tion to hatching of larva varies from 13 to 28 days. In 1968 in Kuze-
 deevsk linden forest 598 eggs were placed under trees for observation;
 larvae hatched from these eggs 14 to 30 days (average 18.3 days) after
 oviposition. During this period the atmospheric temperature was 10.6
 to 28.4°C, with mean daily temperature 17.7°C. In another experiment
 175 eggs were kept under observation on the banks of Lake Telets.
 Larvae hatched from them 13 to 28 days (average 20.7 days) after ovi-
 position. Atmospheric temperature was 5.8 to 28.1°C, with mean daily
 temperature 15.9°C.

Larvae bore into wood, make galleries there along trunk, and plug
 them with fine frass. Mainly decaying wood is colonized. Pupal cell
 made at end of gallery along trunk and larva pupates in it with head
 upward after plugging cell inlet with coarse fibrous frass. Length of cell
 14 mm, width 4.0 mm.

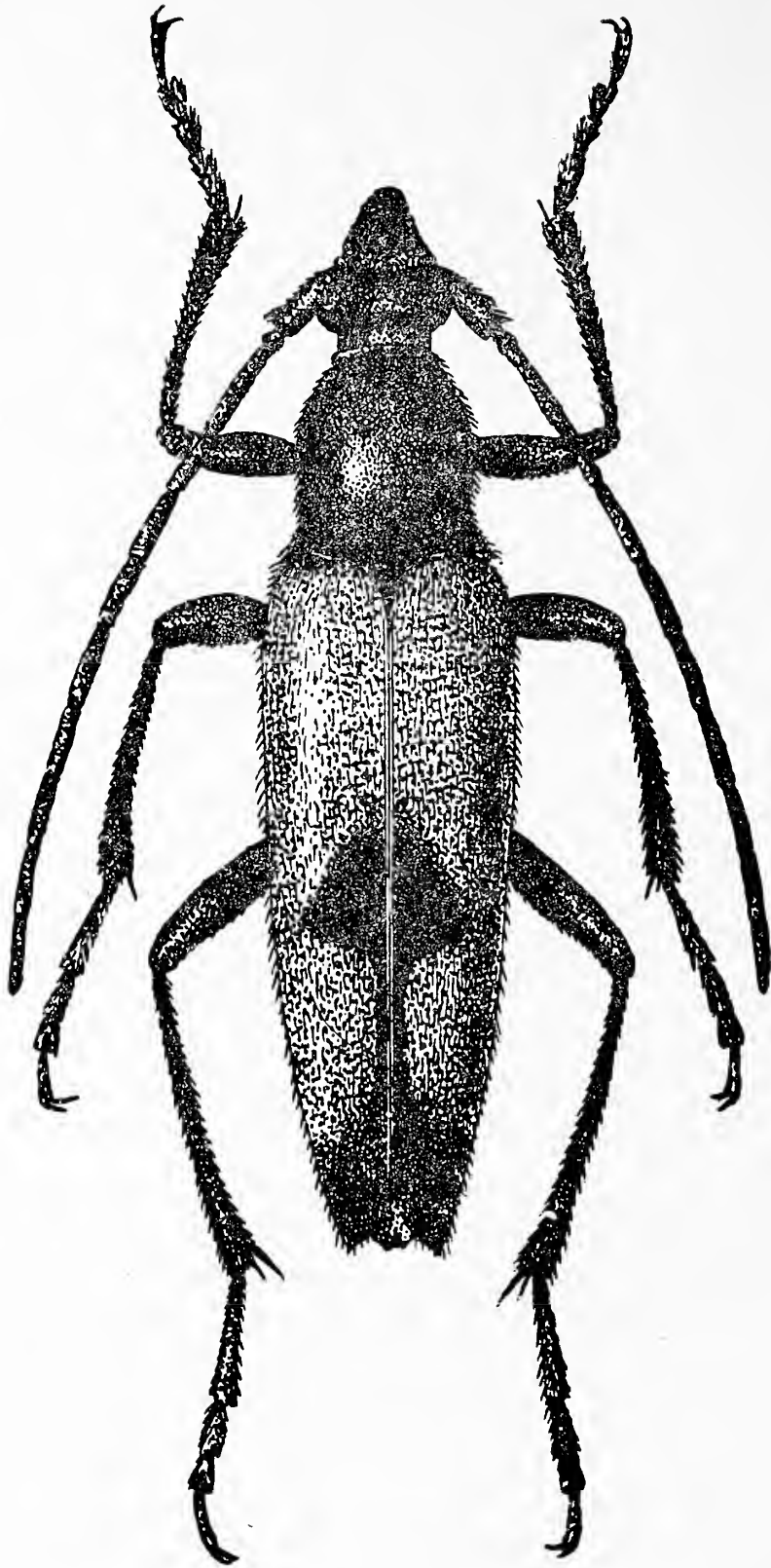
Pupation commences in May and ends in July. Pupal development
 takes 2.5 to 3.0 weeks. Under laboratory conditions at 20°C beetles
 (male) emerged from pupae in 17 days. Emergence of young beetles
 from wood commences in early June. Maximum emergence from pupal
 cells in first half of July. Weight of larvae before pupation 30.5 to 69.5
 mg, pupae 27.0 to 62.5 mg, and beetles before emerging from wood 22
 to 51 mg. Weight of beetles taken from flowers 18 to 29 mg (male) and
 20 to 42 mg (female). I raised beetles from larvae collected from birch.
 Under laboratory conditions larvae developed satisfactorily on linden
 and pine. In nature *Leptura quadrfasciata* L., *Strangalia attenuata* (L.),
 and sometimes *Leptura nigripes* Deg. cononize the same tree together
 with *L. melanura*.

3. *Leptura bifasciata* Müll.

Müller, 1776, *Zool. Dan. Prodr.*, p. 93; Plavil'shchikov, 1936, *Fauna
 SSSR*, 21, 1, 445-446 (*Strangalia*).

Adult (Figure 215): Easily recognized by small body and red abdo-
 men. Head with large punctation on vertex with very dense punctation,
 and with adherent light-colored hairs. Antennae extend beyond 0.50
 (female) or 0.66 (male) length of elytra. Fifth antennal segment longer
 than 4th but shorter than 3rd.

Posterior half of pronotum with parallel sides or slightly compressed
 laterally, narrowly rounded in anterior third, bulges on disk, without
 longitudinal groove; with dense notched even punctation, semiadherent



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Figure 215. *Leptura bifasciata* Müll., female.

short (female) or very long (male) black or light-colored hairs, without flange on anterior margin, with narrow curved border, without transverse groove basally, with posterior angles produced laterally. Scutellum short, apically pointed.

Elytra narrow from base to apex, narrower in male, broaden more at humeri in female; with even sparse punctation, short semiadherent black or light-colored hairs, obliquely truncate at apex, with more or

less rounded inner angles. Hind tarsi slightly longer or almost not longer than tibiae; 1st segment of hind tarsi slightly longer than successive ones together. Body, antennae, legs, and scutellum black; elytra red or brownish-red with black apex, with blackened suture (male) or with broad blackened suture, black transverse band narrowing laterally beyond middle, and black apex (female); abdomen red in region of sternites II to IV (f. *typica*), sometimes posterior third of elytra black, with small reddish spot in middle (ab. *sedakovi* Mannh.). Sometimes legs yellowish-red (ab. *ferruginipes* Pic). Length of body 7.0 to 12.0 mm.

Egg: White, elongate, with parallel sides, gently rounded at poles. Chorion with flat, in middle with faint (visible under high magnification), at ends very distinct cellular sculpture. Spaces between cells thin as though smoothed. Length 1.6 mm, width 0.5 mm.

Larva (Figure 216): Very similar to larva of *Leptura melanura* L. Head narrowly rounded anteriorly, with stray long setaceous hairs laterally in anterior half, pigmented ocellus ventral to antennal bases, and two additional, spottily pigmented ocelli receding posteriorly. Epistoma flat, lustrous, sometimes with faint medial transverse dent. Hypostoma narrows anteriorly, with straight longitudinal sutures, white median longitudinal band, and three to four paramedial setae forming transverse row. Clypeus short, length slightly more than 0.25 width, brownish basally. Labrum transversely oval, small, broadly rounded anteriorly, with short sparse setae along margin. Mandibles broad basally, obliquely notched apically, with acute markedly elongate lower denticle.

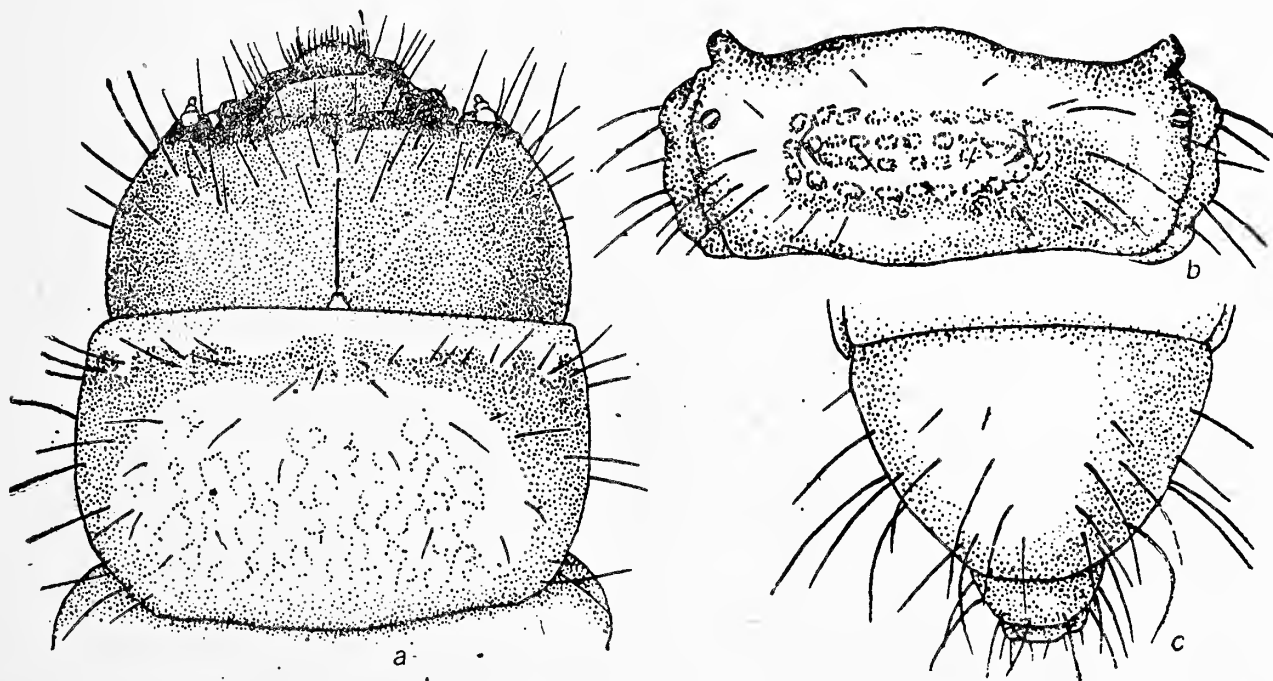


Figure 216. Larva of *Leptura bifasciata* Müll.

a—head and pronotum; b—abdominal tergite with locomotory ampulla;
c—tip of abdomen.

Pronotum bulges, with short stray setaceous hairs on disk and thin hairs laterally, broad transverse yellow band in anterior half interrupted medially by narrow interception and with deep lateral notches along anterior margin; this band does not broaden laterally and does not form broad yellow lustrous area on sides. Pronotal shield white, bulges slightly, with faint longitudinal striation, notably bound laterally at anterior margin, and indistinctly produced anteromedially. Prosternum with sparse short setaceous hairs, appears almost glabrous. Eusternum bulges, lustrous, coriaceous, without sclerotized spinules, laterally with three setaceous hairs, of which anterior and posterior ones long, middle one short.

344 Abdomen almost glabrous, with stray tender hairs only laterally. Dorsal locomotory ampullae on tergites I to VI with four rows of minute granules, of which inner two rows sometimes so proximate they form common transverse carina. Locomotory ampulla on tergite VII usually with two transverse rows of minute granules. Ventral locomotory ampullae on abdominal sternites I to VII with two rows of minute granules. Abdominal tergite IX narrows posteriorly, usually narrowly rounded there, with sparse long hairs in posterior half, four long hairs medially forming transverse row, and short hairs in anterior half forming additional rows. Body length of mature larvae up to 17 mm, width of head about 2.0 mm.

Pupa (Figure 217): Distinguished from pupa of *Leptura melanura* L. by small number of setae on pronotum and other features. Head between anterior lobes of eyes gently impressed, with pair of long setae laterally in region of occipital tubercles, two to three setae in two longitudinal rows along sides of frons at antennal bases, and pair of widely separated short setae slightly in front forming transverse row. Antennae bent annularly, flexed to sides.

Pronotum bulges, slightly narrows anteriorly, elongate, without anterior flange, with piliform setae on anterior margin forming two small tufts (five setae in each) receding posteriorly, with pair of transverse widely separated thin setae, sparse long piliform setae laterally, not raised basally, with five paramedial setae (three thick spinescent and two thin) forming two transverse rows separated by wide interception. Posterior angles of pronotum slightly produced, with long thin hairs. Mesonotum bulges, lustrous, glabrous, without spinules. Stray spinules, resembling specks, laterally in posterior half of metanotum.

Abdomen elongate, narrows posteriorly from segment IV, at tip with pair of urogomphi bent laterally and terminating in sharp sclerotized spinule. Abdominal tergites paramedially with two to three sharp subulate spinules in transverse row and one to two long setae lateral
345 to this row. Abdominal sternites commencing from III with thin usually

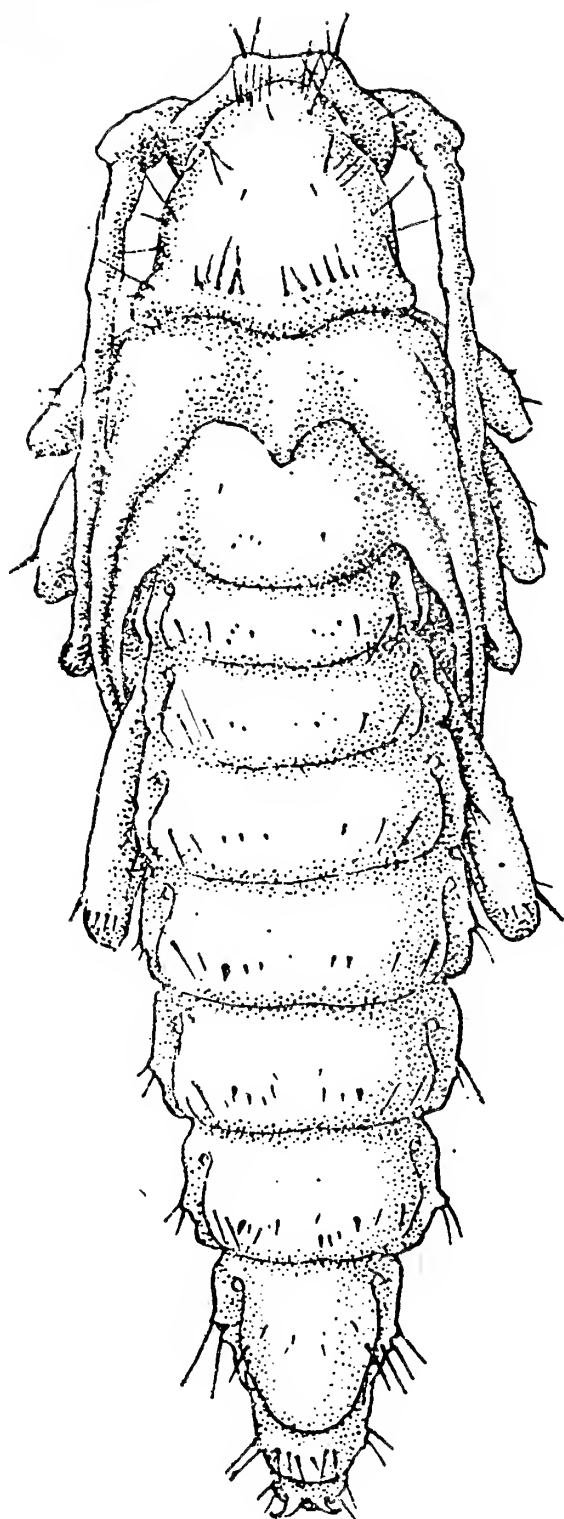


Figure 217. Pupa of *Leptura bifasciata* Müll.

paired piliform setae laterally on posterior margin forming transverse row. Valvifers of female large, hemispherical, laterally produced, spinescent at apex. Length of body up to 12 mm, width of abdomen about 3.0 mm.

Material: From Altai, Salair, Upper Ob' region, and Tuva. Adult insects 368, larvae 42, pupae—one male and one female.

Distribution: Extends from Atlantic to western Trans-Baikal, covers Europe, Asia Minor, and the Caucasus. Northern Asia—the Urals, western Siberian lowland, northern Kazakhstan, Altai, forests of Yenisey

region, Tuva, Baikal region, and western Trans-Baikal. Penetrates northward up to southwest regions of Yakutia.

Biology: Inhabits mixed vegetation. Often found in pine forests of Ob' region close to Novosibirsk. Flight of beetles observed from last 10 days of June almost up to end of August. In southern regions of western Siberia 166 beetles were collected in different years, of which 4.8% were found in last 10 days of June, 68.1%—first half of July, 13.9%—second half of July, 10.8%—first half of August, and 2.4%—second half of August. Flight ceases end of August. Beetles sighted on flowers of *Aegopodium*, *Trollius*, *Spiraea*, *Matricaria*, *Rosa*, and other plants; their gonads mature during supplementary feeding. Even after ovipositing up to six mature eggs were found in the ovaries of females collected from flowers. This indicates that the female returns for renewed feeding in between ovipositing. Embryonic development in nature continues for about three weeks. Larval hatching commenced on September 4th from eggs laid on August 8th to 16th, and on September 8th from eggs laid on August 16 to 20. Under laboratory conditions females colonized rotten and solid wood of birch and fir shoots; in nature eggs are laid in basal zone of pine undergrowth. In 1977 we kept 57 eggs under observation in the laboratory. At 20.6 to 26.6°C ($23 \pm 0.3^\circ\text{C}$) development from time of oviposition to hatching of larvae took 10 to 15 days, average 11.8 ± 0.2 days.

On hatching larvae make galleries initially under bark, then in wood along shoot, plugging them with frass. Larvae quite often move from upper layers to deeper ones or, contrarily, return to outer layers from deeper layers of wood. Pupal cell made closer to surface along shoot at end of gallery and both ends are plugged with coarse fibrous frass. Length of cell 12 mm, width 4.0 mm. Length of frass plug at cell inlet 11 mm, at opposite end 7.0 mm.

346 Pupation commences early June and ends early July. Weight of larvae before pupation 25 to 60 mg, pupae 20 to 54 mg, and young beetles 17 to 44 mg. Weight of beetles collected from flowers in last 10 days of July 10 to 24 mg (male) and 22 to 39 mg (female).

4. *Leptura vicaria* (Bat.)

Bates, 1884, *J. Linn. Soc. Lond. Zool.*, vol. 18, p. 218 (*Strangalia*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 437–438 (*Strangalia*); Gres-sit, 1951, *Longicorn Beetles of China*, vol. 2, p. 101 (*L. oblitterata vicaria* Bat.); Kojima and Hayashi, 1969, *Insect Life in Japan*, vol. 1, p. 33 (*Nakanea*).

Adult (Figure 218): Easily recognized by structure of pronotum and stable color of elytra. Head with upright flange behind eyes, raised longitudinal frontal tubercles between antennae, flat between posterior

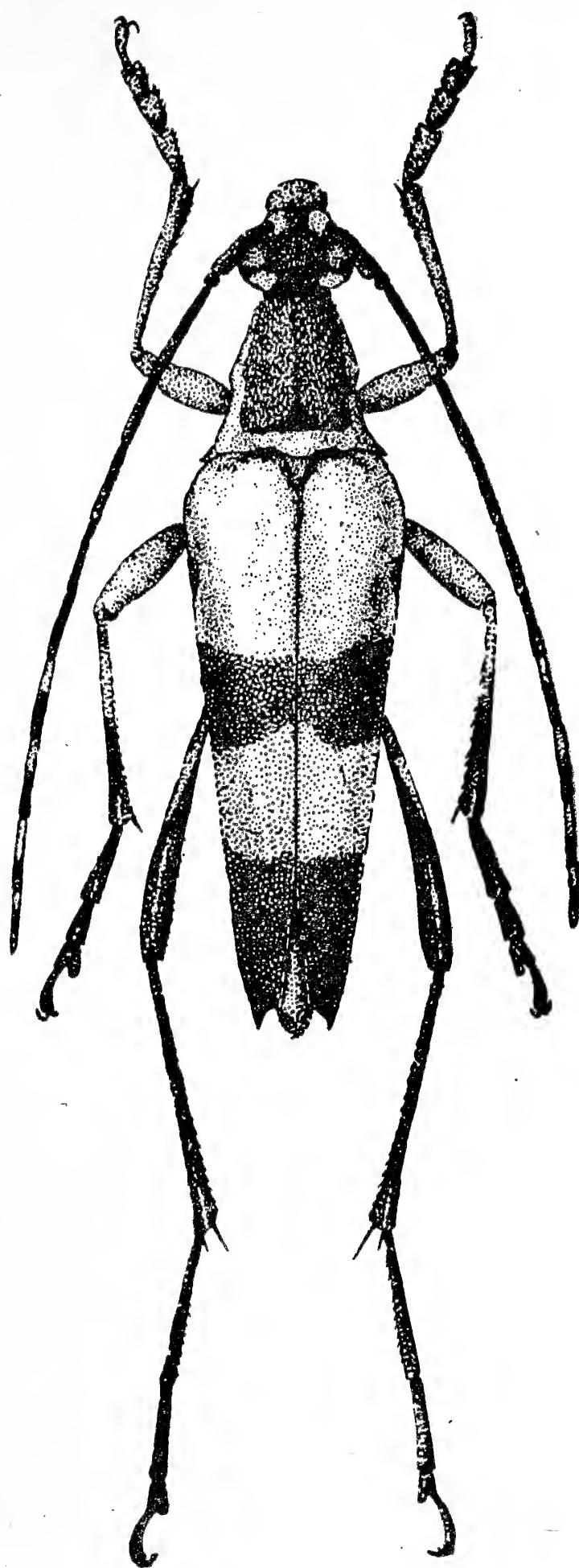


Figure 218. *Leptura vicaria* (Bat.).

lobes of eyes; with dense minute punctation, minute light-colored hairs, and narrow median longitudinal groove. Genae elongate, almost as long as eyes. Antennae comparatively long, extend beyond middle of elytra in female, almost reach or just short of reaching elytral apex in male. Third segment of antennae considerably longer than 5th.

Pronotum elongate, markedly narrows anteriorly, with angular broadening ventrolaterally anterior to middle, sharply impressed transversely at base, with slightly flattened posterior angles acutely produced laterally, slightly bulges on disk, with deeply grooved longitudinal dent on hind clivus in middle of base (dent narrows anteriorly); with minute close punctation and adherent, comparatively dense, light-colored hairs. Scutellum abruptly narrows basally, notably elongate apically, narrowly rounded or pointed posteriorly.

Elytra elongate, markedly narrow from base to apex, uniformly bulge on disk; with fine punctation not forming thin transverse striation, minute brownish semiadherent hairs, and obliquely and deeply notched apically. Body black. Elytra straw-yellow, with small spot laterally behind humeral tubercle, broad medial transverse band, and broad
347 band anterior to apex black. Head black; genae, temples, sometimes frontal tubercles at antennal bases light yellowish-rust. Pronotum laterally and border on base yellowish-rust, disk black. Abdominal sternites I to IV posteriorly with light yellow bands that broaden transversely in middle. Antennae at base of segments with rusty ringlets; sometimes apex entirely rusty. Fore- and midlegs rusty, tarsi brown or brownish-rust, hind legs black. Length of body 14 to 20 mm.

Egg: White, elongate, with parallel sides, broadly rounded at one pole and narrowly at the other. Chorion smooth, without cellular sculpture. Length 1.8 mm, width 0.5 mm.

Larva (Figure 219): Similar to larva of *Leptura circaocularis* (Pic). Differs in structure of dorsal locomotory ampullae. Head broad and thick, broadens laterally in posterior half; with long setaceous hairs in anterior half and three more or less pigmented ocelli lateral to antennal bases forming band. Epistoma bound laterally by straight whitish frontal sutures, divided medially by brownish-cinnamon longitudinal suture, distinctly visible between apex and transverse white band. Hypostoma markedly narrows anteriorly, slightly rounded laterally; with white longitudinal gula, long and short piliform setae, 11 to 13 setae on each side of gula. Labrum narrows apically, angularly rounded, with sparse long setae along edge, glabrous, almost flat disk, with very short thin setae at base and pair of long setae in transverse row anterior to middle.

Pronotum transverse, with slightly bulging lustrous disk, uniform transverse yellow band in anterior half; laterally on anterior margin

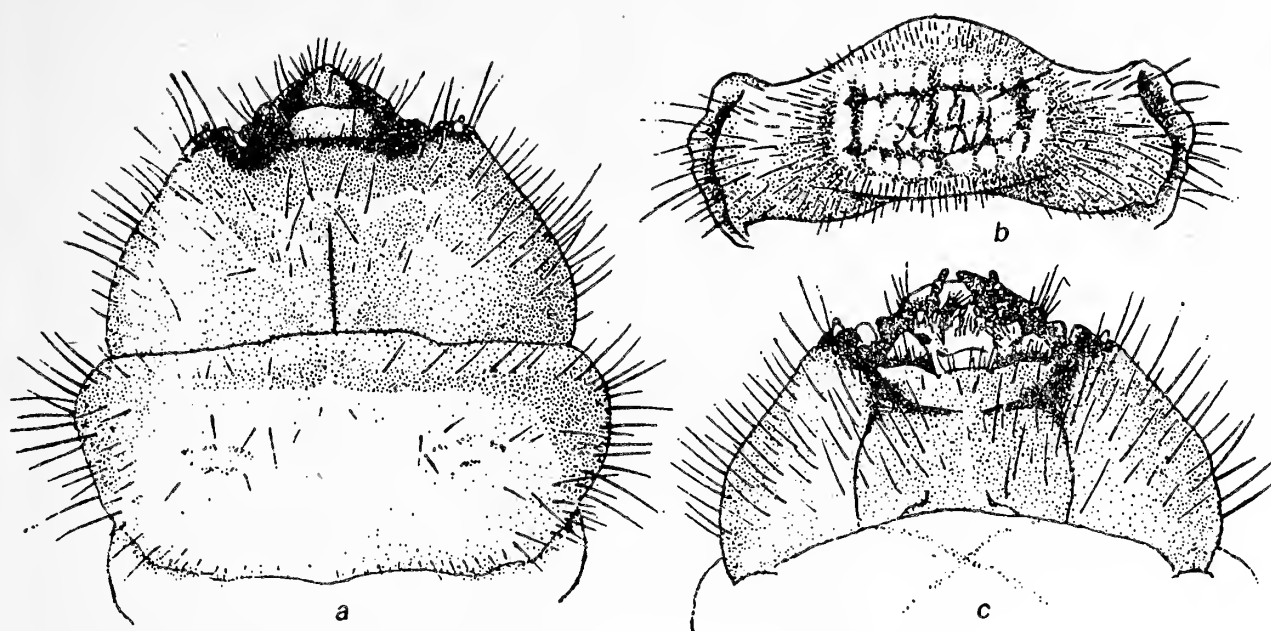


Figure 219. Larva of *Leptura vicaria* (Bat.).

a—head and pronotum; b—abdominal tergite with locomotory ampulla; c—head (ventral view).

with setaceous hairs forming transverse row. Pronotal shield white, bulges slightly, sometimes with brownish spots on anterior margin, shallow striation, and short sparse setaceous hairs forming transverse row at base. Prosternum with paired long and short hairs. Eusternum bulges, coriaceous, with uniformly spaced hairs almost throughout surface, among which up to five long hairs prominent in background of short hairs.

348 Abdomen laterally with dense hairs. Dorsal locomotory ampullae developed on abdominal tergites I to VII, bulge, with large granules fusing into transverse rows. Inner two rows so close that they form a common transverse carina set with six to eight medial setae demarcating two inner rows of granules. Width of carina almost 2.0 times width of anterior row of granules (in *Leptura circaocularis* they are equal in width). Ventral locomotory ampullae developed on abdominal sternites I to VII, with large round granules forming two parallel rows. Abdominal sternites and tergites VIII to IX with long hairs throughout surface. Length of body up to 28 mm, width of head up to 4.5 mm.

Pupa (Figure 220): Readily distinguished from pupa of *Leptura circaocularis* (Pic) by well-developed urogomphi at tip of abdomen. Head between upper lobes of eyes slightly impressed with five setae laterally on occipital protuberances, setae on inner side of antennal bases forming tuft (of five to eight setae), transverse striation on anterior part of frons, and raised margin with six to seven setae forming transverse row. Antennae acutely curved, flexed to sides.

Pronotum bulges slightly, considerably narrows anteriorly, with large

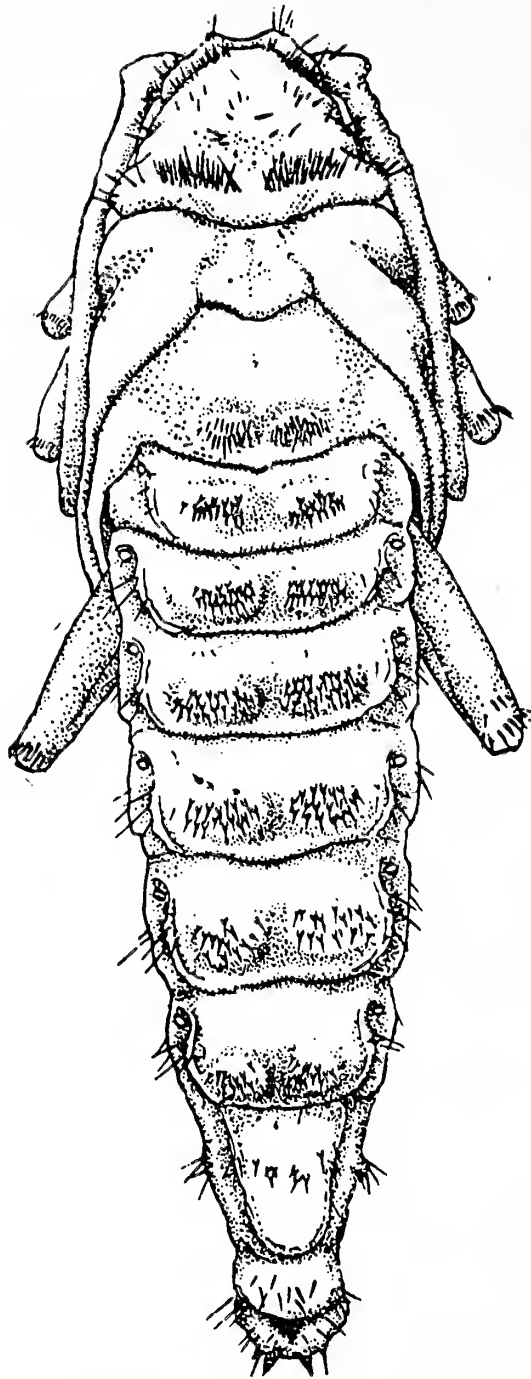


Figure 220. Pupa of *Leptura vicaria* (Bat.).

setae on anterior margin forming dense transverse band broadly interrupted medially, stray thick setae on lateral margin directed backward, and prominent transverse striation on disk; sparse, scattered, thick, acicular, erect setae on posterior margin, and here with dense acicular setae forming two transverse bands separated from each other by medial dent on base (raised portion obliquely striate). Mesonotum glabrous, saddle shaped. Metanotum bulges, with pair of tubercular protuberances at base densely covered with acicular spinules directed backward.

Abdomen gradually narrows posteriorly, more elongate at apex. Abdominal tergites bulge, with median longitudinal groove; acicular spinules along each side of groove on protuberant coriaceous base from tuft of 14 to 20 spinules each. Tip of abdomen obtuse (ventral view),

bound by horseshoe-shaped carina set with a few short setaceous spinules; terminally (dorsal view) with pair of well-developed urogomphi with sharp sclerotized apical spinule. Abdominal sternites laterally with minute setae directed inward and backward. Valvifers of female hemispherical, slightly flattened, with projecting tubercle at apex directed sideways. Length of body 23 mm, width of abdomen up to 6.0 mm (female).

349 *Material*: Collected in Sakhalin and Kunashir. Adult insects 263, larvae 30, pupa—one female, larval and pupal exuviae with beetles from cells two each.

Distribution: Sakhalin, Kuril' Islands (Kunashir and Shikotan); Japan.

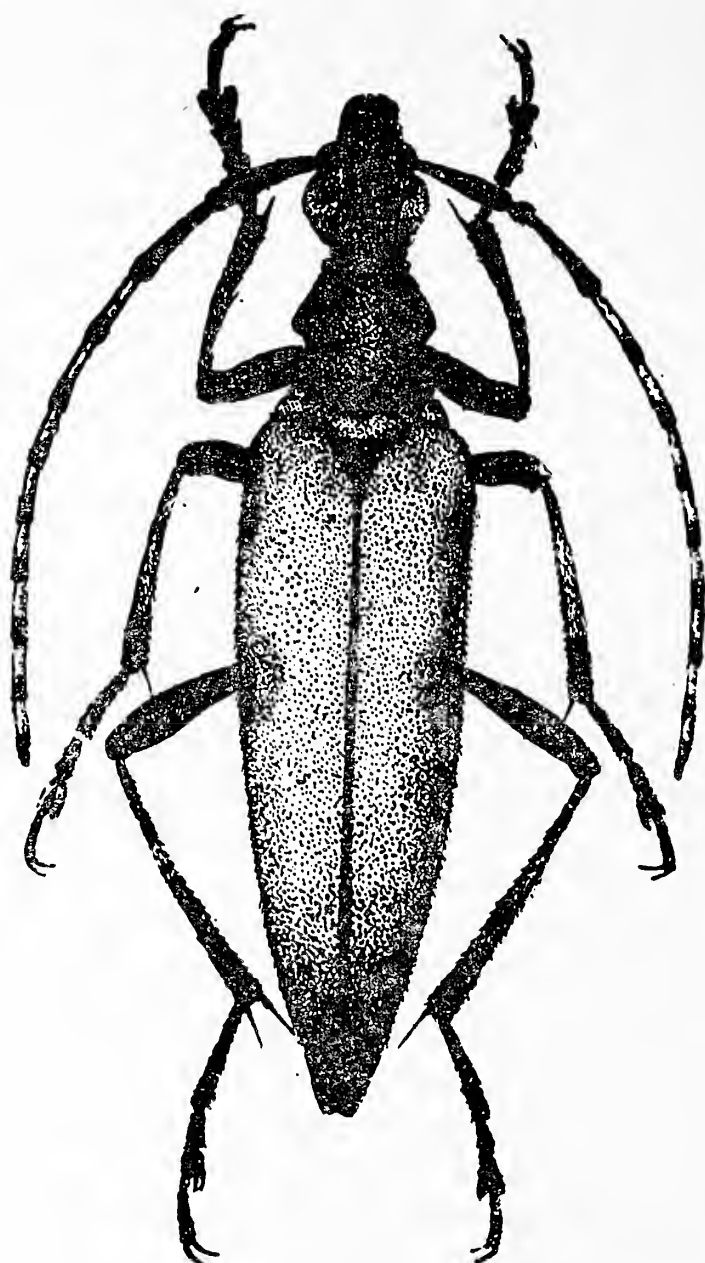
Biology: Inhabits coniferous and mixed forests on Pacific Ocean islands. Ecologically restricted to fir-spruce vegetation. Flight of beetles commences mid-July and continues up to September inclusive, maximum in August. In 1974 on Kunashir Island, during systematic collection from June through August 25, 228 beetles were collected: seven (3.0%)—July 15, 33 (14.5%)—second half of July, 48 (21.1%)—first half of August, and 140 (61.4%)—second half of August. Beetles sighted on flowers of Umbelliferae, Rosaceae, and other plants. Often seen on hydrangea (*Hydrangea paniculata*). Female lays eggs on dead fallen fir in bark crevices and wood fissures. Fecundity comparatively high. Ovaries of one female emerging from wood on July 31 and dissected on August 7th, contained 248 eggs; or another female picked from flowers on August 9th, 187 eggs; and a third female collected August 22, also from flowers, 49 eggs. This indicates that beetles return periodically for renewed feeding.

Larvae live in solid and rotten wood, make galleries along trunk, and plug them with fine frass. Before pupation a cell is made along trunk. Length of cell 25 mm, width 15 mm. Larvae pupate in June and July. Young beetles sighted in July and early August. Emergence from wood ceases in first 10 days of August. Weight of larvae before pupation 143 to 450 mg, pupae 130 to 368 mg, and beetles 75 to 267 mg. Weight indexes of female slightly higher than those of male.

5. *Leptura circaocularis* (Pic)

Pic, 1934, *Echange*, p. 18 (*Strangalia*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 436–437 (*Strangalia*); Gressit, 1951, *Longicorn Beetles of China*, vol. 2, p. 98.

Adult (Figure 221): Body comparatively large. Head with median longitudinal suture, raised frontal tubercles at antennal bases, broadly impressed between posterior lobes of eyes, with short densely pubescent temples, and minute close punctation; punctation on clypeus sparse,



350

Figure 221. *Leptura circaocularis* (Pic), female.

very large. Eyes bulge markedly, narrowly emarginate on inner side. Antennal apices extend just beyond 0.50 (female) or 0.66 (male) length of elytra, with broad yellowish or yellowish-cinnamon ringlet at base of segments commencing from 4th. Fifth antennal segment longer than 4th, distinctly shorter than 3rd.

Pronotum compressed laterally in posterior half, angularly broadens anterior to middle, narrows in anterior third, with narrow flange, broad transverse groove at base, more or less flattened posterior margin, smooth median longitudinal groove, quite often with alveolar impression on hind clivus; with dense punctation and adherent, not very dense, light-colored or rusty hairs and sparse erect long hairs laterally. Scutellum insignificantly elongate, with fine punctation, narrowly or broadly rounded apically. Elytra broaden at humeri, markedly narrow from base posteriorly, broadly notched apically, with fine close, at places trans-

versely fused punctation forming thin transverse striation, with short light-colored yellowish hairs. Apices of hind femora only extend up to 0.66 length of elytra. First segment of hind tarsi longer than successive two together.

350 Posterior margin of abdominal sternite V broadly notched in male, rounded in female. Body ventrally with light-colored yellowish hairs. Body black; genae, temples, sides and posterior margin of pronotum sometimes more or less yellowish-rust. Bases of antennal segments, commencing from 4th, with yellowish-rust, light-colored ringlets. Elytra straw-yellow, with black spots laterally beyond humeri and anterior to middle, narrow suture linearly and margins laterally darkened (f. *typica*); sometimes elytra smoky-black with yellowish light-colored spots or bandlike smears, sometimes entirely black. Length of body 15 to 21 mm.

Egg: Markedly elongate, narrows more toward one end and broadly rounded at the other. Chorion smooth; flat cellular sculpture visible under high magnification only at poles. Spaces between cells very fine, as though obliterated. Length 2.0 to 2.1 mm, width 0.5 mm.

Larva (Figure 222): Characterized by three ocelli at bases of antennae, locomotory ampullae developed on abdominal segments I to VII, more elongate hypostoma, and other features. Head transverse, markedly rounded behind middle, broadens almost angularly, markedly narrows anteriorly and posteriorly, with three ocelli forming transverse band laterally at antennal bases. Epistoma in middle of posterior half slightly impressed longitudinally, with distinct transverse white band, well-developed brownish longitudinal suture extending apically from white band, and four setae along each side of suture forming longitudinal row. Frontal sutures white, narrow, slightly concave in posterior half. Hypostoma bulges slightly, 2.0 times wider than long, rounded laterally, narrows more anteriorly, with white median longitudinal band, and uniformly spaced setae along sides of band covering surface (14 to 16 long setae on each side). Clypeus whitish, trapezoidal, markedly narrows toward apex. Labrum reddish-rust, broadens angularly at base, markedly narrows anteriorly, narrowly rounded apically, with short setae on anterior margin, and long setae on disk forming transverse row. Outer side of mandibles with broad transverse, longitudinally striate band, obliquely truncate apically, with lower denticle produced, rostriform.

Pronotum laterally with long, disk with short, uniformly spaced setaceous hairs; transverse yellow band in anterior half broadens flatly laterally, without deep notches in anterior margin, and here with setaceous hairs forming lateral transverse row. Pronotal shield bulges insign-
351 nificantly, with leathery striation, white. Prosternum with sparse long

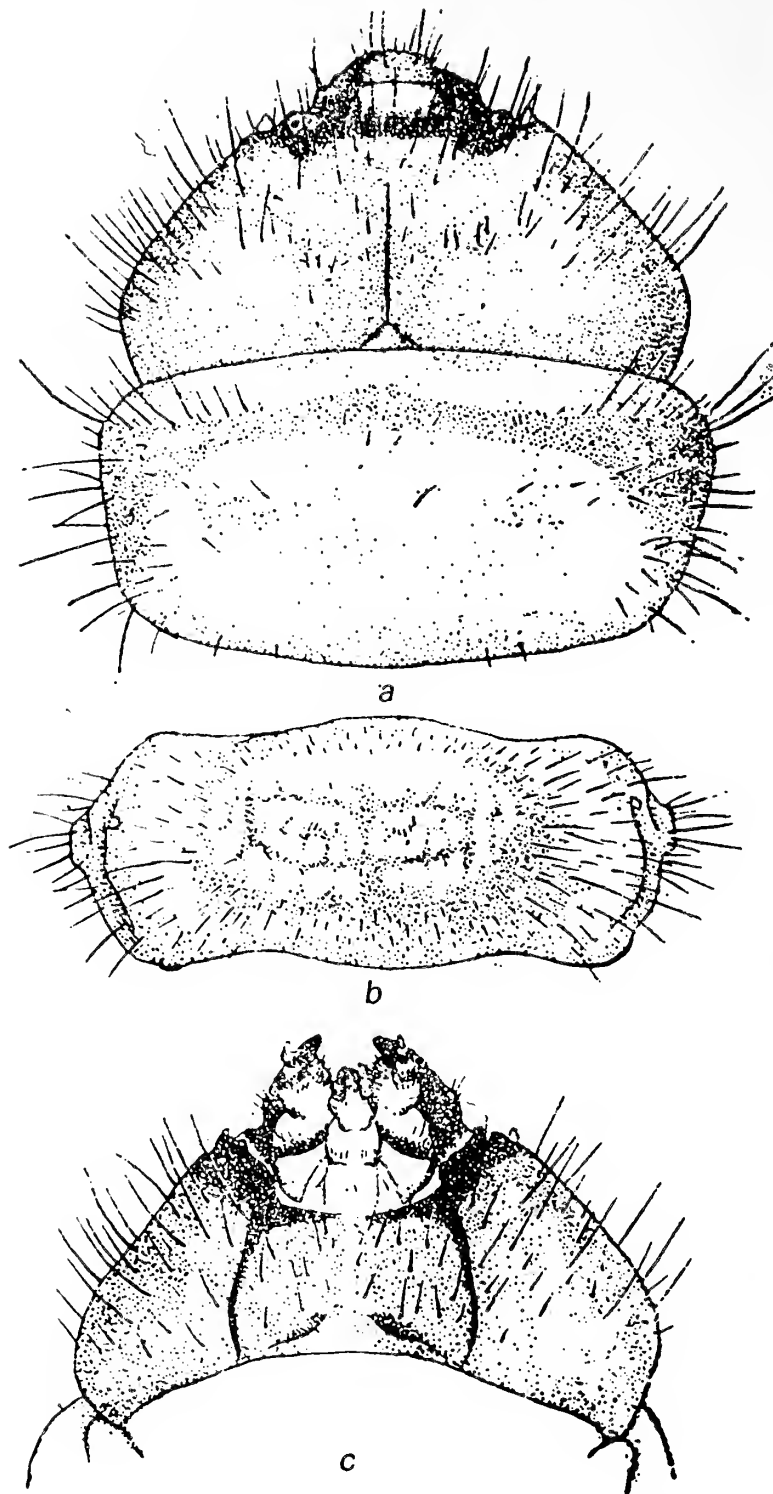


Figure 222. Larva of *Leptura circaocularis* (Pic).

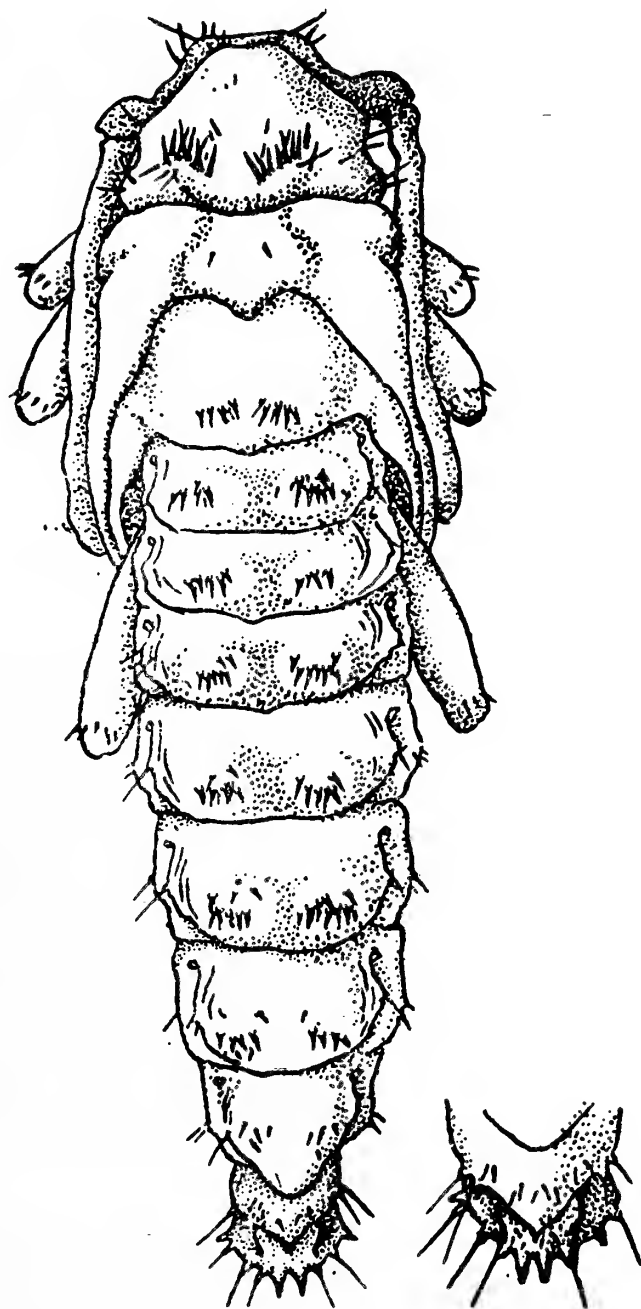
a—head and pronotum; b—abdominal tergite with locomotory ampulla;
c—head, ventral view (tentorial pits visible at base of hypostoma).

setaceous hairs. Eusternum with leathery striation and almost entirely covered with uneven hairs.

Abdomen laterally comparatively highly pubescent. Dorsal locomotory ampullae developed on tergites I to VII, transversely oval, bulge, with well-developed granules forming two distinct ellipses. Inner rows markedly proximate. Locomotory ampulla on tergite VII with two rows of granules. Ventral locomotory ampullae transversely elongate, with

large granules forming two parallel transverse rows, and dense rusty hairs laterally. Abdominal tergite IX with abundant long hairs, surface almost entirely covered. Body white; head reddish-rust, blackish-brown on anterior margin of epistoma. Mandibles black. Body length of mature larvae 23 to 26 mm, width of head 5.5 mm.

Pupa (Figure 223): Well distinguished by arrangement of spinules on tip of abdomen. Head between antennae bulges transversely, broadly impressed between upper lobes of eyes, with long thick setae forming small tufts along sides of occipital tubercles and at bases of antennae on inner side; three pairs of acicular spinules on anterior margin of frons, of which two laterally at base of clypeus, one with median upward projection. Antennae arcuate, flexed to sides.



Pronotum bulges insignificantly, with parallel sides in posterior half, narrows in anterior half, without flange, with acicular spinules on anterior margin forming two transversely elongate tufts separated by broad smooth median interception; minute spinules on posterior half of disk densely concentrated in middle and sparse elsewhere; slightly raised margin at base with large and minute spinules forming dense transverse paramedial band; posterior angles slightly produced. Mesonotum glabrous or with pair of widely separated spinules. Metanotum with median longitudinal groove; thick spinules in posterior half of base, acicularly pointed at tip, form two tufts separated medially by a narrow interception (13 to 17 spinules in each tuft).

Abdomen elongate, with parallel sides; segment V narrows, obtuse posteriorly, rounded along margin (dorsal view) and here with 10 spinules; without perceptible urogomphi at tip. Abdominal tergites bulge in posterior half, with pointed acicular spinules on protuberant coriaceous base forming two compact, transversely elongate tufts separated by median longitudinal groove; each tuft with 13 to 26 spinules in female and five to ten in male. Abdominal sternites laterally with minute (male) or very large (female) acicular spinules. Valvifers of female narrow toward base, spherically rounded at apex, with tubercular projection laterally. Length of body 16 to 21 mm, width of abdomen 4.0 to 5.5 mm.

Material: Collected in Kunashir (Alekhino and Sernovodsk). Adult insects 127, including 94 raised in laboratory, larvae 260, pupae—six males and five females, exuviae of larvae and pupae with beetles from cells 45 each.

Distribution: Sakhalin and Kunashir. Abundant in Kunashir around Alekhino and Sernovodsk.

Biology: Inhabits mixed and coniferous vegetation. Ecologically associated with spruce and fir. Flight of beetles commences first half of July and continues up to September. Beetles found on flowers of different plants. Maximum end of July and early August. Female lays eggs in bark crevices, wood fissures of dead fallen trees, logs cast ashore on sea coasts, and trunks and beams lying on the ground; quite common in moist sites. One female can lay a large number of eggs. For example, ovaries of a female removed from the pupal cell contained 206 mature eggs. In 1974 in Kunashir egg development in nature took about three weeks. Larvae began to hatch on August 11 from eggs laid July 19 to 23. Atmospheric temperature during this period was 13.5 to 32.0°C, with mean daily temperature 19.6°C.

Larvae live in wood, make galleries along trunk, and plug them with frass. Width of gallery up to 14 mm. Sometimes galleries merge to form considerable niches in wood entirely plugged with frass. After second or third hibernation larva makes cell in wood along trunk sur-

face, plugs it with coarse fibrous frass, and pupates in cell with head toward exit. Length of cell 40 to 45 mm, width 10 to 18 mm.

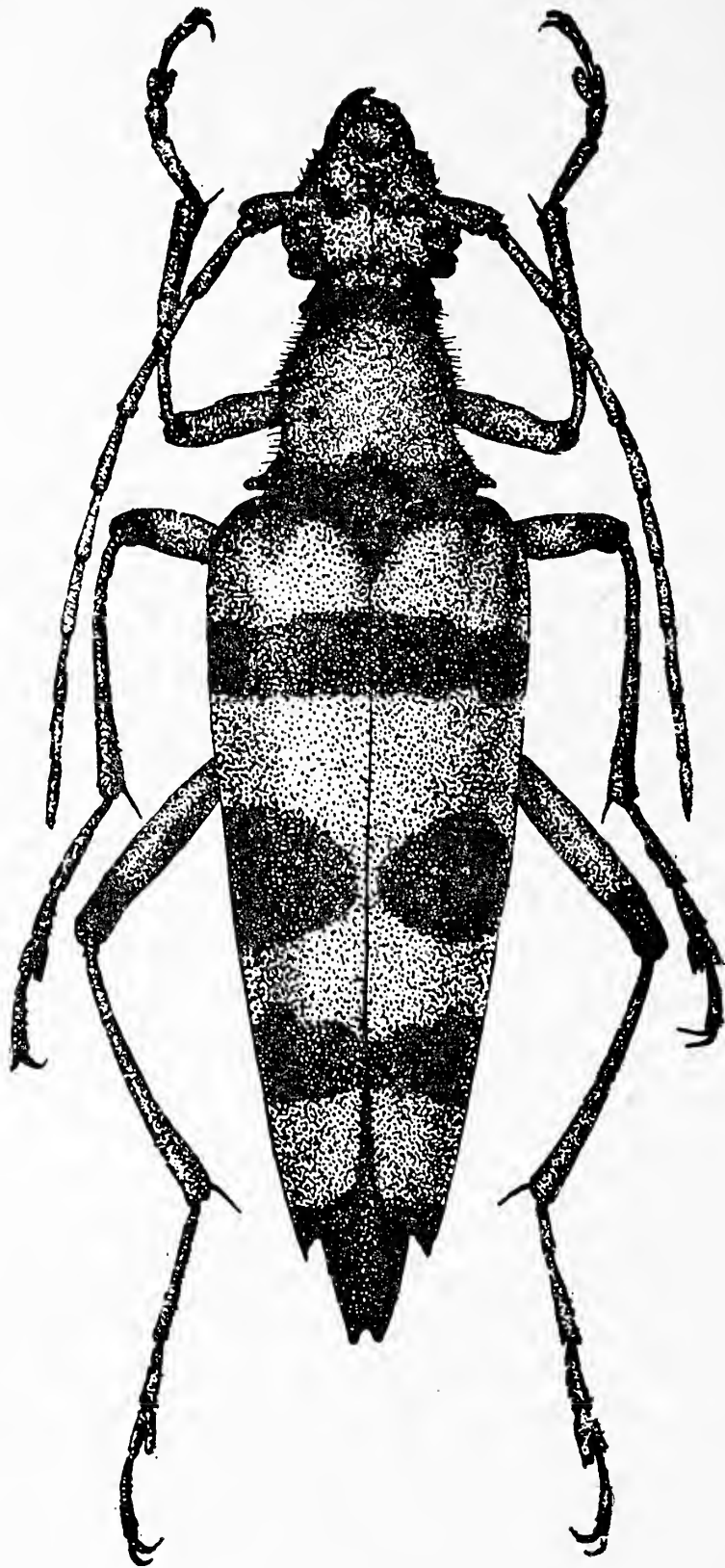
353 Pupation of larvae commences in June and ceases in July. In 1974 pupae developed in about three weeks. Atmospheric temperature during this period 6.0 to 26.0°C. Pupae maximum end of June and in early July. Young beetles sighted in wood in last few days of June and found up to middle 10 days of August. Emergence of beetles from wood commences July 2nd and ends in first 10 days of August. Thus in nature, around Alekhino, 85 beetles were recovered from wood, of which three (3.5%) were found in first 10 days of July, eight (9.5%)—middle 10 days, 37 (43.5%)—last 10 days of July, and 37 (43.5%)—first 10 days of August. Beetles emerge from wood with developed gonads and are capable of reproduction without supplementary feeding. Weight indexes in different developmental stages partly reflect the sexual dimorphism of this species. For example, in males weight of larvae before pupation was 148 to 260 mg, pupae 135 to 236 mg, and young beetles 71 to 170 mg; corresponding values for females: 208–436, 180 to 396, and 148 to 267 mg respectively. Population density in wood comparatively high. We cut five strips from a dead fallen tree (spruce) totaling in length 207 cm and diameter 30 to 39 cm. In these strips 305 specimens of *Leptura circaocularis* (Pic) were found, including 260 larvae, four pupae, and 41 young beetles in pupal cells. *Leptura vicaria* (Bat.), *Leptura regalis* (Bat.), and *Anoplodera succedanea* (Lew.) often colonize together with this species.

6. *Leptura regalis* (Bat.)

Bates, 1884, *J. Linn. Soc. Lond. Zool.*, vol. 18, p. 223 (*Strangalia*); Pic, 1901, *Bull. Mus. Par.*, vol. 7, p. 61; Gressitt, 1951, *Longicorn Beetles of China*, vol. 2, pp. 101–102; Kojima and Hayashi, 1969, *Insect Life in Japan*, vol. 1, p. 33 (*Macroleptura*).

Adult (Figure 224): Body massive, large. Head with almost parallel sides, upright flange behind; with minute close punctation, narrow smooth linear suture in middle; cervix with very large distinct punctation. Frontal tubercles sharply raised at antennal bases, diverge posteriorly. Eyes large, finely faceted, angularly emarginate on inner side. Antennae thin, short, barely reach middle of elytra; 1st antennal segment moderately thickened; 2nd transverse, 2.0 times wider than long; 3rd equal to 5th, longer than 4th; 11th elongate, longer than 5th, and obtusely rounded apically.

354 Pronotum narrows anteriorly, with narrow deep flange anteriorly, bent anterior margin, and bulges on disk; with fine close punctation, smooth median longitudinal groove, steeply raised, wartlike in posterior half of base, with smooth curved transverse groove, broadly flattened

Figure 224. *Leptura regalis* (Bat.), female.

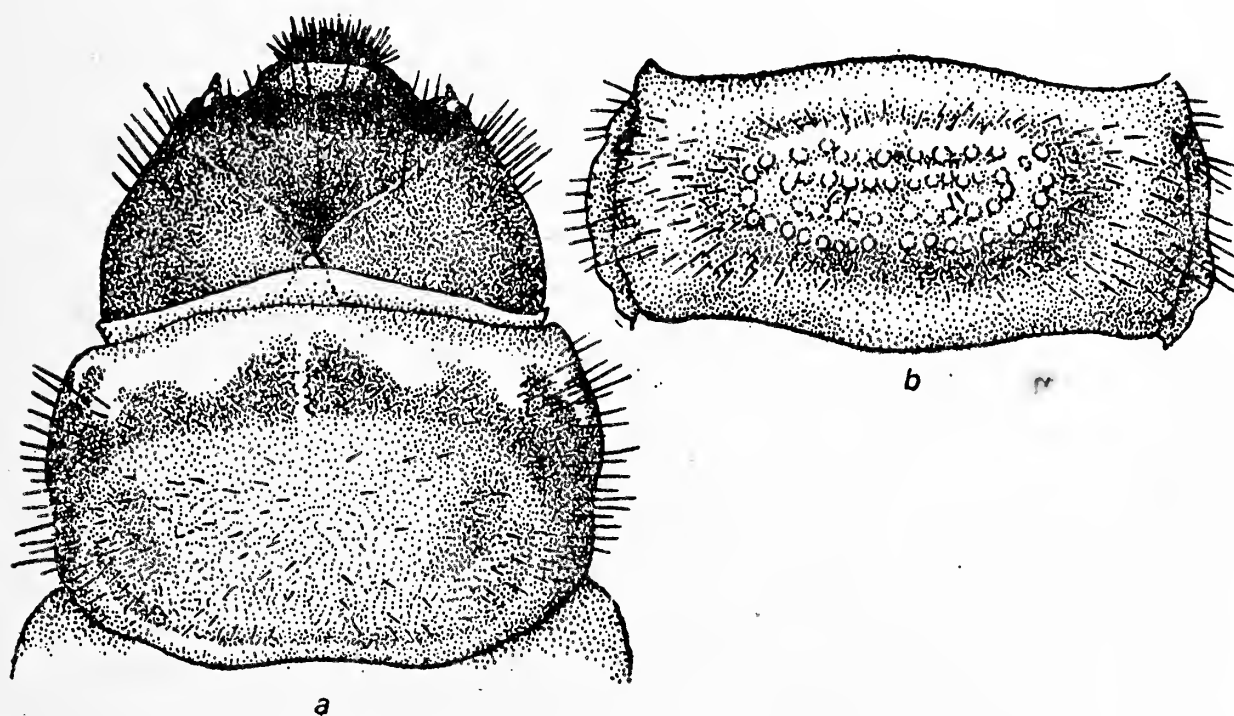
at base and with sparser punctation here, with spinescent pointed posterior angles produced laterally, and semiadherent short hairs. Scutellum triangular, with fine punctation, produced apically, with golden hairs forming brushlike tuft. Elytra elongate, bulge, distinctly narrow posteriorly, apically notched with acute angles, and with minute close even punctation; fine adherent hairs visible under high magnification. Hind femora thicken slightly toward apex, almost even. Hind tarsi not

longer than tibiae, 3rd segment bifurcate up to middle. Body ventrally with golden (thorax with denser) adherent hairs.

Abdominal tergite V elongate in female, angularly notched posteriorly, with smooth median longitudinal band. Sternite V narrows posteriorly, angularly notched posteriorly, with longitudinal dent medially at base, and longitudinal groove in posterior half; finely punctate throughout, smooth band lacking. Head, pronotum, posterior half of four abdominal sternites, and partly metathorax red. Eyes, head laterally and ventrally, scutellum, pronotum anteriorly and posteriorly, thorax ventrally, base of first four sternites, and abdominal sternite V entirely black. Antennae and legs rusty-red; apices of femora and also mid- and hind tibiae darkened. Elytra reddish-rust, with three transverse black bands and black apex. Length of body 29 mm.

Egg: White, elongate, barely flexed, obtusely rounded at one pole, produced at the other, pointed. Chorion smooth, with fine cellular sculpture visible under high magnification only at poles. Length 2.1 mm, width 0.5 mm.

Larva (Figure 225): Very similar to larva of *Leptura thoracica* Creutz. Differs in presence of trilobate brownish spot at apex of epistoma and other features. Head laterally rounded, 2.0 times wider than length along median suture. Epistoma longitudinally impressed in posterior half, black on anterior margin, medially with indistinct whitish transverse band covered with long very dense setae, basally with brownish sclerotized ringlets, brownish in posterior half, with three brownish lobate



a

b

Figure 225. Larva of *Leptura regalis* (Bat.).
a—head and pronotum; b—abdominal tergite
with locomotory ampulla.

branches extending anteriorly along sutures. Posterior half of frontal sutures slightly concave, longitudinal suture distinct, obliterated only in anterior third. Hypostoma slightly narrows anteriorly, entirely covered with dense setae, with white gular band in middle. Clypeus bulges, lustrous, white. Labrum bulges, glabrous on disk, with long setae on margins. Mandibles massive, gently notched apically, lower denticle produced, rostriform, outer side polished, lustrous apically, with matte transverse groove in middle.

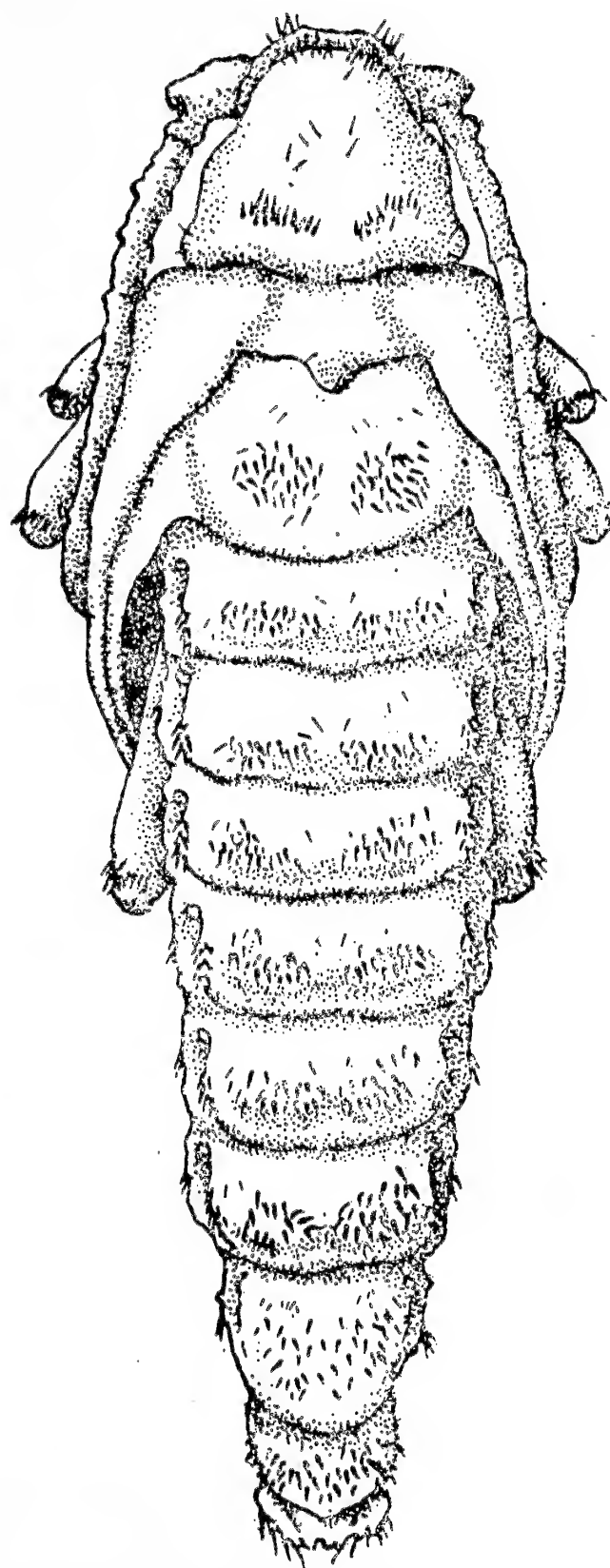
Pronotum 2.0 times wider than long, rounded laterally, bulges slightly on disk, with sparse setaceous hairs, broad rusty transverse band in anterior half, and in mature larvae with numerous variegated elongate and oval dark brown specks. Pronotal shield bulges, with sinuous striation, rusty, demarcated from rest of pronotum by white field. Prosternum with long and short setaceous hairs. Eusternum coriaceous in anterior half and middle, sclerotized laterally close to base, with minute spinules forming two round fields as in *Leptura thoracica* Creutz. Thoracic legs well developed.

- 355 Abdomen with setaceous hairs encircled basally by sclerotized ringlets. Dorsal locomotory ampullae with distinct granules forming two transversely elongate ellipses; granular rows of inner ellipse notably shifted apart with stray or paired setae between them forming transverse row. Ampulla of tergite VII with three rows of granules, posterior row absent. Ventral locomotory ampullae on abdominal sternites I to VII with two rows of granules. Body length of mature larvae 45 to 55, width of head up to 7.0 mm.

Pupa (Figure 226): Differs from other species in the presence of long spinules on anterior margin of pronotum, and absence of urogomphi on tip of abdomen. Body markedly elongate. Head shortened, with three spinules on frons at base of antennae, spinules on anterior margin of clypeal base forming transverse row, and paired spinules on labrum posterolaterally. Antennae short, flexed, arcuate.

- 356 Pronotum narrows anteriorly, transversely striate, with thick acicular spinules at base forming two transverse bands separated medially. Group of long, almost acicular spinules on anterior margin form transverse band; disk with stray acicular spinules. Mesonotum bulges, transversely striate, with or without stray spinules. Metanotum transversely striate, with acicular spinules in posterior half forming two extensive tufts (30 to 32 spinules per tuft).

Abdominal tergites elongate, slightly wider than long, with thick subulate spinules in posterior half forming two transverse bands separated by longitudinal groove (16 to 18 spinules on each side). Tip of abdomen (dorsal view) rounded and with acicular spinules, without urogomphi. Valvifers of female contiguous, insignificantly elongate.



355

Figure 226. Pupa of *Leptura regalis* (Bat.).

Length of body 33 mm, width of abdomen 6.0 to 8.0 mm.

Material: From Kunashir. Adult insect one, larvae 37, pupae—one male and one female.

Distribution: Southern Sakhalin and Kunashir; Japan from Hokkaido to Kyushu.

Biology: Inhabits forests of Pacific Ocean islands. Beetles sighted in July and August. I found them in Kunashir. Female found on August

3rd. Larvae and pupae found in two dead fallen trees of Sakhalin spruce near Alekhino on sea coast in surf zone.

Larvae live in wood, make longitudinal galleries, and plug them with frass. Width of galleries at places up to 18 mm. Larva makes cell along trunk at end of gallery and pupates in it. Length of cell 40 mm, width 15 mm. Weight of single female collected 650 mg; dissection revealed 265 eggs in the ovaries.

7. *Leptura thoracica* Creutz.

Creutzer, 1799, *Entom. Vers.*, p. 125; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 418-420 (*Strangalia*); Gressit, 1951, *Longicorn Beetles of China*, vol. 2, p. 102; Kojima and Hayashi, 1969, *Insect Life in Japan*, vol. 1, pp. 33-34 (*Macroleptura*).

Adult (Figure 227): Body large and massive. Head short, slopes slightly forward, with steep, not very large flange behind temples, minute even punctation on frons and vertex, narrow median longitudinal suture, transversely raised between antennae, with not very dense hairs on temples, and uneven punctation on cervix interspersed with smooth area. Eyes slightly emarginate. Apices of antennae reach beyond middle of elytra (male) or do not reach this level (female).

Pronotum bulges on disk, markedly narrows anteriorly, posterior angles produced laterally, transverse smooth flange anteriorly, with moderate, sometimes smoothened punctation, and semiadherent short black or rusty hairs. Scutellum triangular and flat, sometimes acutely produced apically. Elytra bulge, wider than pronotum at humeri, often with distinctly humeral tubercle, narrow gently toward apex but more steeply in posterior fourth, narrowly notched apically, with jagged punctation and minute semiadherent hairs. Femora moderately thickened; hind tibiae straight.

Abdomen in female thick; sternite V insignificantly emarginate terminally, with faint broad flat groove in posterior half. Abdomen in male slender; sternite V elongate, with deep trough-shaped groove in posterior half, and produced posterior angles. Color highly variable. Body black; pronotum red, often with black border anteriorly and posteriorly (f. *typica*), sometimes with indistinct black longitudinal band in middle (ab. *discovittata* Plav.), sometimes entirely darkened (ab. *obscurissima* Pic). Antennae black with rusty base, or entirely rusty. Legs black or rusty, sometimes only forelegs rusty. Quite often entire body, 357 elytra, antennae, and legs rusty; sometimes abdominal sternites darkened to some extent. Length of body 19 to 30 mm.

Egg: White, markedly elongate, obtusely rounded at one pole gently pointed at the other. Chorion with faint flat cellular sculpture, more distinct at poles. Spaces between cells faintly visible under high magnification, appear obliterated. Length 2.8 mm, width 0.6 mm.

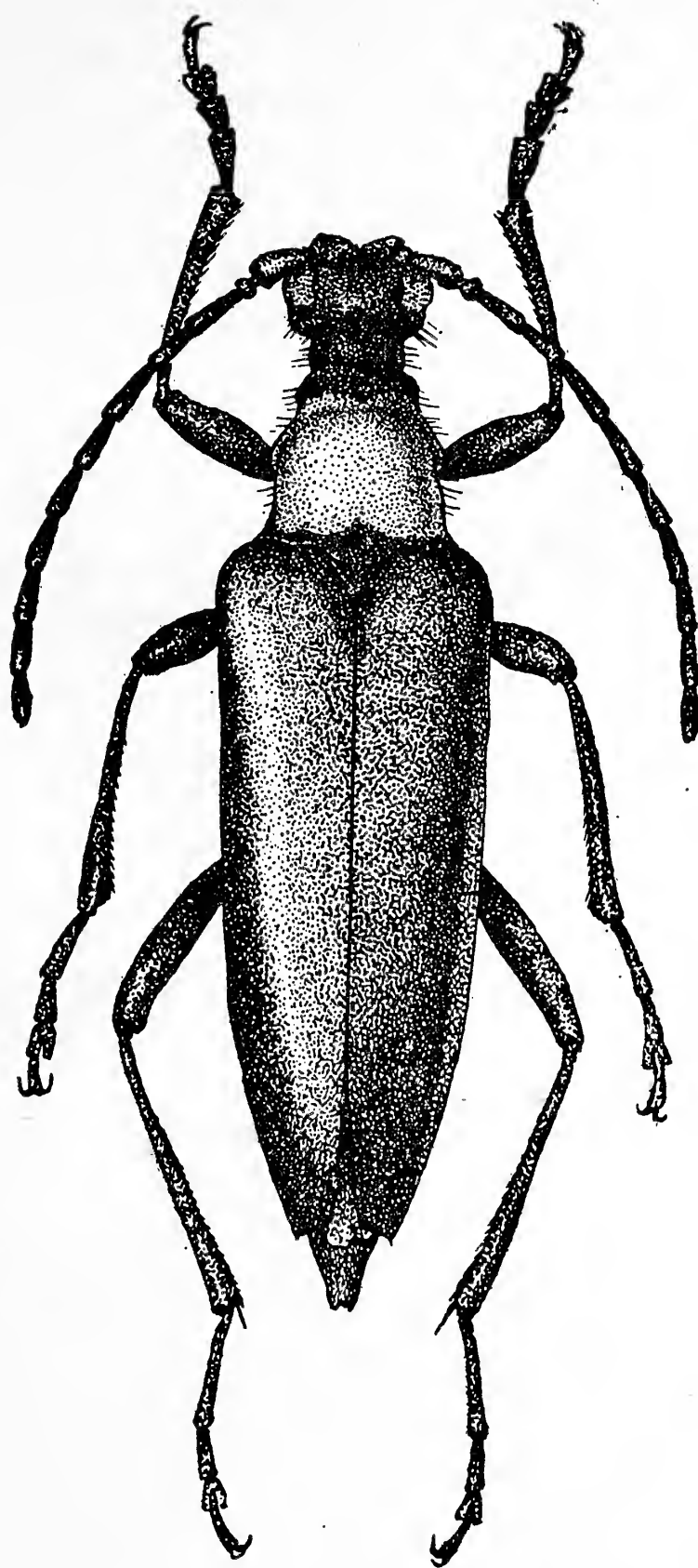
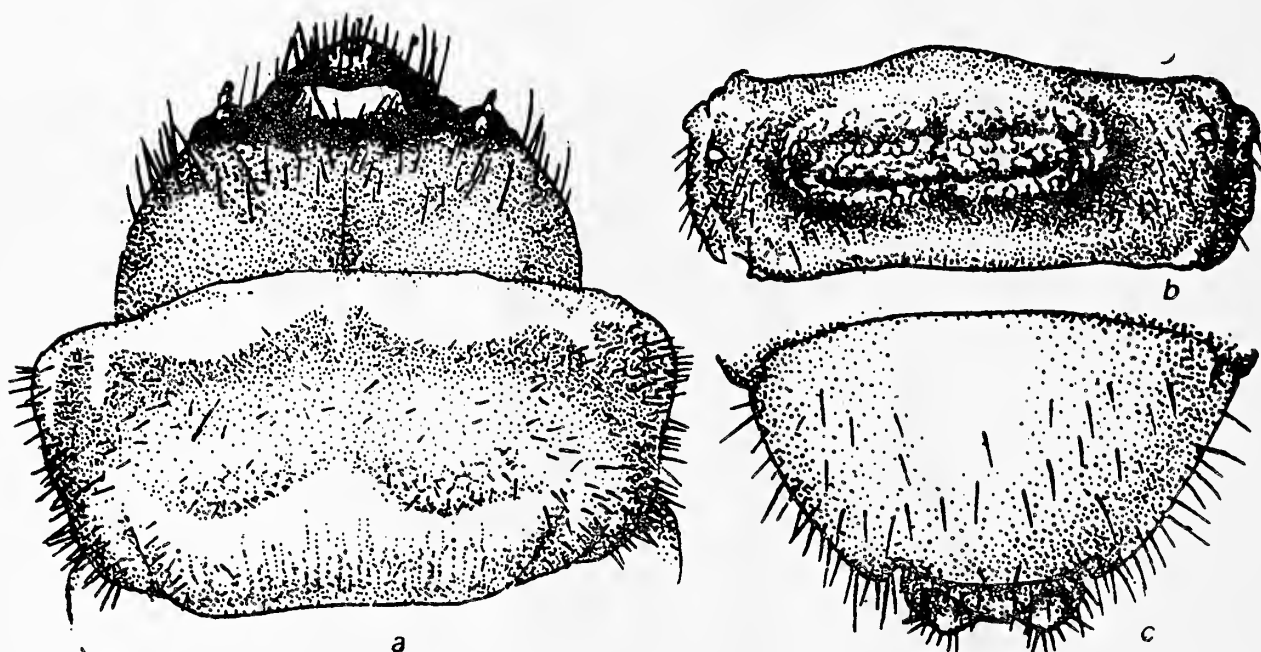


Figure 227. *Leptura thoracica* Creutz., female.

Larva (Figure 228): Characterized by large body in mature stage, presence of faint locomotory ampullae on abdominal tergite VII, two sclerotized spots on eusternum, and other features. Head in posterior third broadly rounded, insignificantly narrows anteriorly, with dense hairs laterally in anterior half. Epistoma black or blackish-brown along

anterior margin, smoky apically, whitish medially, with very dense setaceous hairs. Frontal sutures straight, whitish, and distinct. Longitudinal suture markedly obliterated anterior to middle. Hypostoma slightly narrows anteriorly, bulges slightly, with acute anterior angles, narrow white median longitudinal band, and very numerous setaceous pores (20 pores on each side of longitudinal band). Clypeus markedly narrows anteriorly, bulges, whitish, with narrow rusty-brown band at base. Labrum bulges, glabrous on disk, whitish, with short setae along margins, brownish-rust basally.



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Figure 228. Larva of *Leptura thoracica* Creutz.

a—head and pronotum; b—abdominal tergite with locomotory ampulla;
c—tip of abdomen.

Pronotum 2.0 times wider than long, with broad transverse rusty-yellow band in anterior half interrupted medially by narrow longitudinal clearance, white, shagreen, and matte on anterior margin, with dispersed, moderately long setaceous hairs on disk, and short setae in front of shield forming indistinct transverse row directed forward. Pronotal shield bulges slightly, without lateral longitudinal folds, striate, white, glabrous, with stray setae only at base. Prosternum with uniform setaceous hairs; proplesternum glabrous. Eusternum bulges, lustrous and coriaceous in anterior half, with sparse large setae, two large sclerotized brownish spots in posterior half along angles at base; spots rounded on inner side. Anterior clivus between legs with minute sclerotized spinules.

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Abdomen laterally with sparse short thin hairs. Dorsal locomotory ampullae developed on first six abdominal segments, ellipsoidal, bulge, divided by narrow median longitudinal groove, with distinctly develop-

ed granules. Inner rows of granules proximate, form common transverse carina with stray short setae. Locomotory ampulla on tergite VII devoid of granules, in form of narrow transverse shagreen fold. Small granules visible on this ampulla only in mature larvae. Ventral locomotory ampullae present on abdominal sternites I to VII, divided by transverse groove, with minute granules forming two rows. Body length of mature larvae 35 to 40, width of head up to 6.5 mm.

Pupa (Figure 229): Characterized by short acute spinules dorsally, absence of developed urogomphi on tip of abdomen, and large massive body. Head insignificantly elongate anterior to antennae, with long acicular spinules forming some longitudinally elongate tufts behind and at base of antennae, six spinules on anterior margin of frons form transverse row. Antennae comparatively short, arcuate.

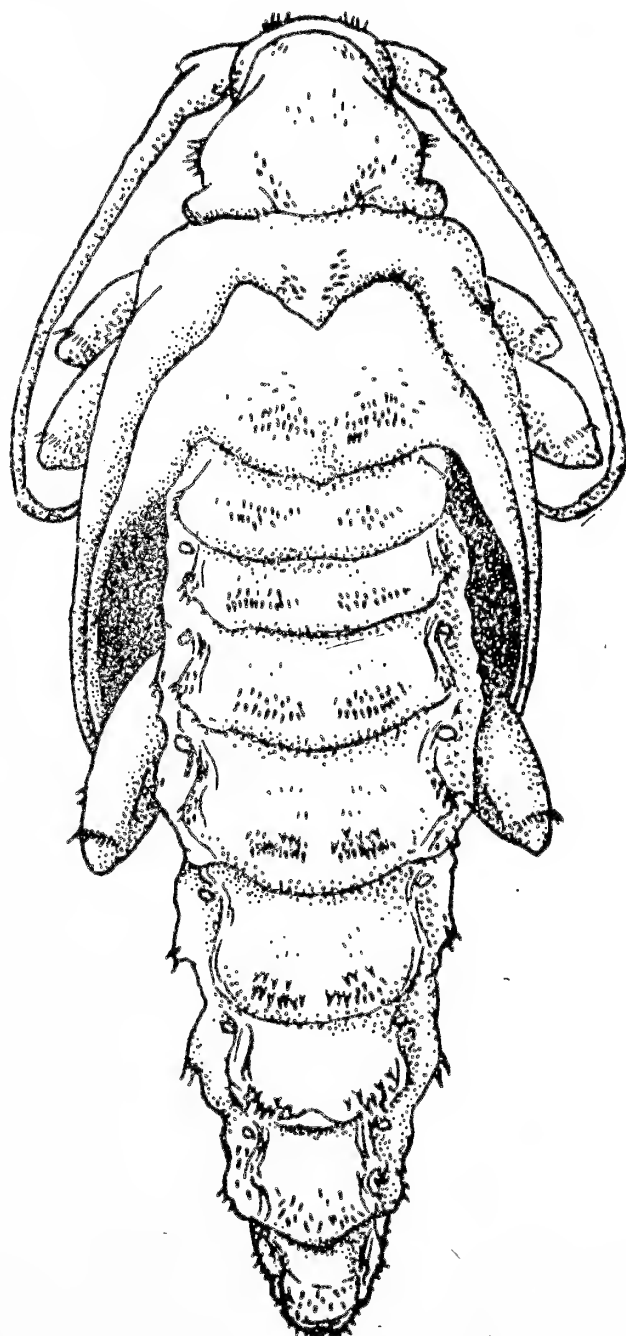


Figure 229. Pupa of *Leptura thoracica* Creutz.

Pronotum narrows anteriorly, with two emarginations basally, with rounded posterior angles, bulges on disk, with faint transverse groove not forming flange on anterior margin; short acute spinules form broad tuft on disk behind middle, and transverse row at base and on anterior margin. Meso- and metanota bulge, with numerous spinules forming two extensive tufts in posterior half.

Abdomen markedly elongate. Abdominal tergites bulge, with short acute spinules forming one transversely elongate tuft along sides of longitudinal groove. Tip of abdomen (ventral view) obtuse, bound laterally by large horseshoe-shaped carina densely covered with minute spinules. Urogomphi absent. Valvifers of female hemispherical, produced
359 laterally at apex. Length 28 mm, width of abdomen 7.0 to 8.0 mm.

Material: From forests of Ob' region, Altai, Tuva, Baikal region, and Primor'e. Adult insects 142, including 90 raised in the laboratory, larvae 132, pupae—eight males and eight females.

Distribution: West and eastern Europe, Siberia from the Urals to Pacific Ocean coast, Sakhalin; northern Mongolia, northern China, Korea, and Japan. More common in Altai, southern Ob' region, eastern Siberia, and in broad-leaved forests of Ussuri-Primor'e region.

Biology: Inhabits deciduous forests, ecologically associated with deciduous wood species. Flight of beetles from June through August inclusive, sighted more often in July. Seen on flowers of different herbaceous plants. Emerge from wood with mature gonads. Number of eggs detected in ovaries of females dissected soon after emerging from pupal cells as follows: 148, 120, 98, and 98. Female lays eggs under intact bark and in wood fissures of stumps, dead standing thick-trunked, and dead fallen trees. Development of eggs in forests takes 12 days. In 1969 in Salair larvae hatched July 26 through 28 from eggs laid July 11 through 16. Mean daily temperature during this period 18.9°C. Larvae live much of their life in wood, make galleries, and plug them with fine frass. Pupal cell at end of gallery 30 to 40 mm long, 10 to 12 mm wide.

Pupation commences end of May or in June and ceases toward end of June. Pupae found in large numbers in last 10 days of June. Pupal stage continues for 20 to 28 days. Young beetles seen end of June. Beetles maximum in first half of July. On gaining strength they nibble round openings 5.0 to 8.0 mm in diameter on trunk surface. Mass emergence of beetles from wood seen in first half of July. Weight variation during metamorphosis exemplified by the following data: six pupae collectively weighed 3,201 mg (average 533.5 mg) and beetles emerging from them 2,450.2 mg (average 408.3 mg), i.e., during adult formation total weight of insects dropped 23.5%. Weight of larvae before pupation 139.7 to 1,098 mg, pupae 127 to 990 mg, and beetles 103 to 740 mg.

Leptura thoracica Creutz. develops on dead, quite often rotten wood.

Found more often in trunks of linden, maple, birch, and willow. I recovered 90 beetles from wood in nature as follows: 40 from linden, 13—maple, 10—birch, nine—willow, eight—*Syringa*, six—willow, three—oak, and one—alder. This species also lives on aspen and other deciduous vegetation. Quite often colonizes linden together with *Callipogon relictus* Sem., and birch and aspen with *Leptura quadrifasciata* L., *L. nigripes* Deg., *L. duodecimguttata* (F.), and *Necydalis major* L.

8. *Leptura quadrifasciata* L.

Linnaeus, 1758, *Syst. Nat.*, 10th ed., p. 389; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 422-424 (*Strangalia*); Gressit, 1951, *Longicorn Beetles of China*, vol. 2, p. 101.

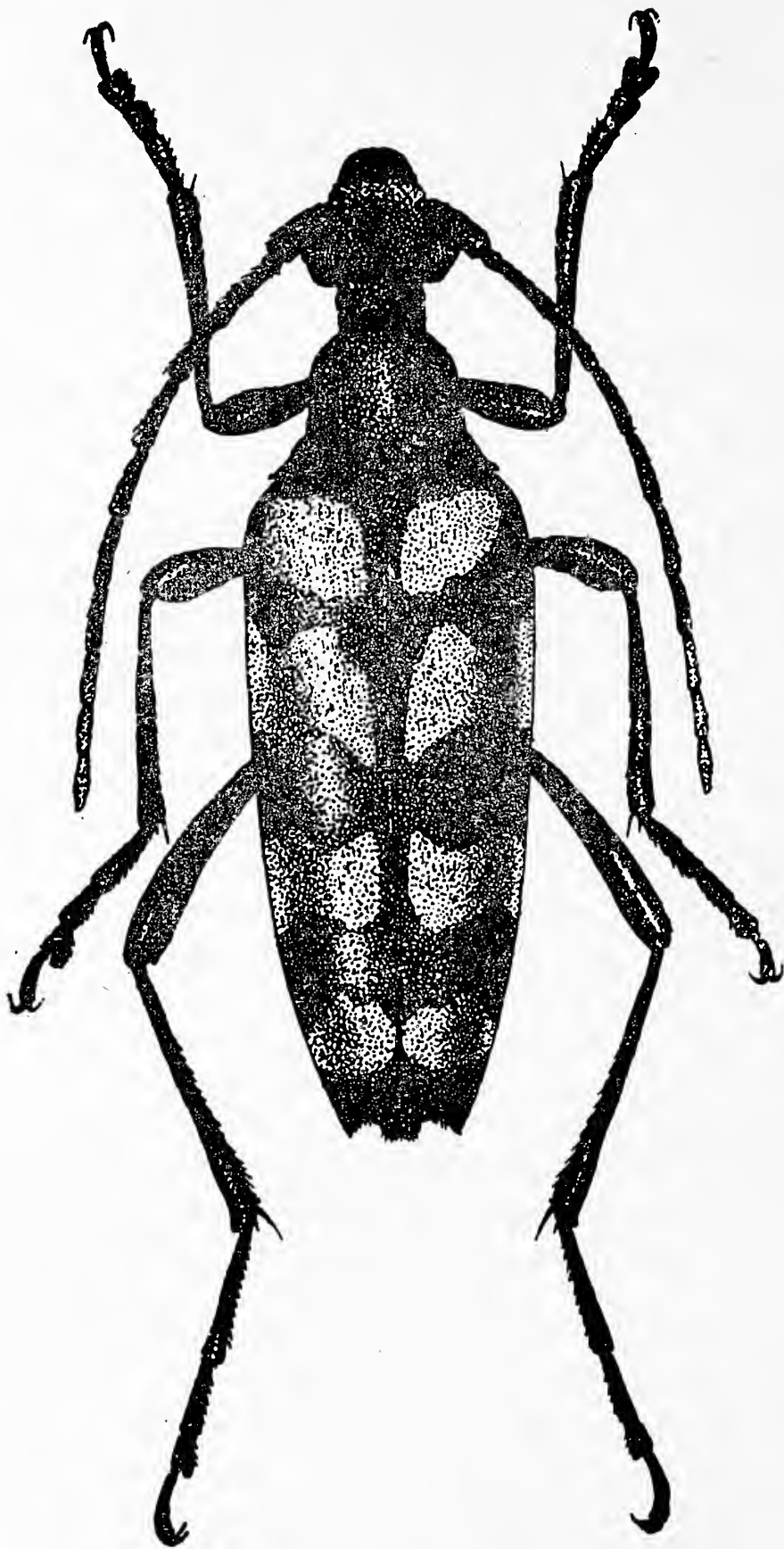
Adult (Figure 230): Readily distinguished from other species by color of elytra. Head with close fine punctation, short upright temples, and short flat broad part of frons before antennae. Cervix elongate, with dense punctation. Antennae in female extend just beyond middle of elytra, reach their apex in male. First antennal segment basally 0.50 thickness at apex, markedly longer than 4th, not shorter than 3rd; 11th segment narrows apically, markedly elongate, with almost parallel sides in posterior third with perceptible flange (male) or comparatively short and narrows from base to apex (female).

Pronotum bulges, campanulate, narrowly rounded in anterior third, with narrow deep flange anteriorly, posterior angles acutely produced laterally, deep transverse groove at base; with close even punctation, sometimes with grooved smooth longitudinal band in middle with more (male) or less (female) developed, easily obliterated hair cover.

Elytra gradually narrow posteriorly, bulge insignificantly; with minute notched punctation forming, at places, thin transverse striation, with short light-colored hairs; obliquely notched apically with outer angle more produced. Body black. Antennae black, sometimes (mainly in female) rusty at apex. Elytra rusty-yellow, with black border basally, blackened apically, and three pubescent transverse black bands on disk, of which one in anterior half, second in middle, and third in posterior half; disk thus appears divided into four rusty yellow transverse bands (f. *typica*). In some specimens transverse bands considerably reduced or, contrarily, so greatly enlarged that some stray yellowish-rust spots remain on elytra. Length of body 11 to 22 mm.

Egg: White, elongate slightly toward one end, narrows more steeply toward the other, and narrowly rounded at both poles. Chorion with distinct flat large-celled sculpture; spaces between cells comparatively thick. Length 2.0 to 2.1 mm, width 0.6 mm.

Larva (Figure 231): Characterized by dorsal locomotory ampullae on abdominal tergites I to VI and sclerotization of eusternum. Head

Figure 230. *Leptura quadrifasciata* L.

narrowly rounded anteriorly, with dense hairs laterally in anterior half. Epistoma distinctly impressed along longitudinal suture in posterior half, with long piliform setae at anterior angles forming small tuft; faint whitish indistinct transverse band anterior to middle, more often lacking. Hypostoma slightly narrows anteriorly, with very dense setae

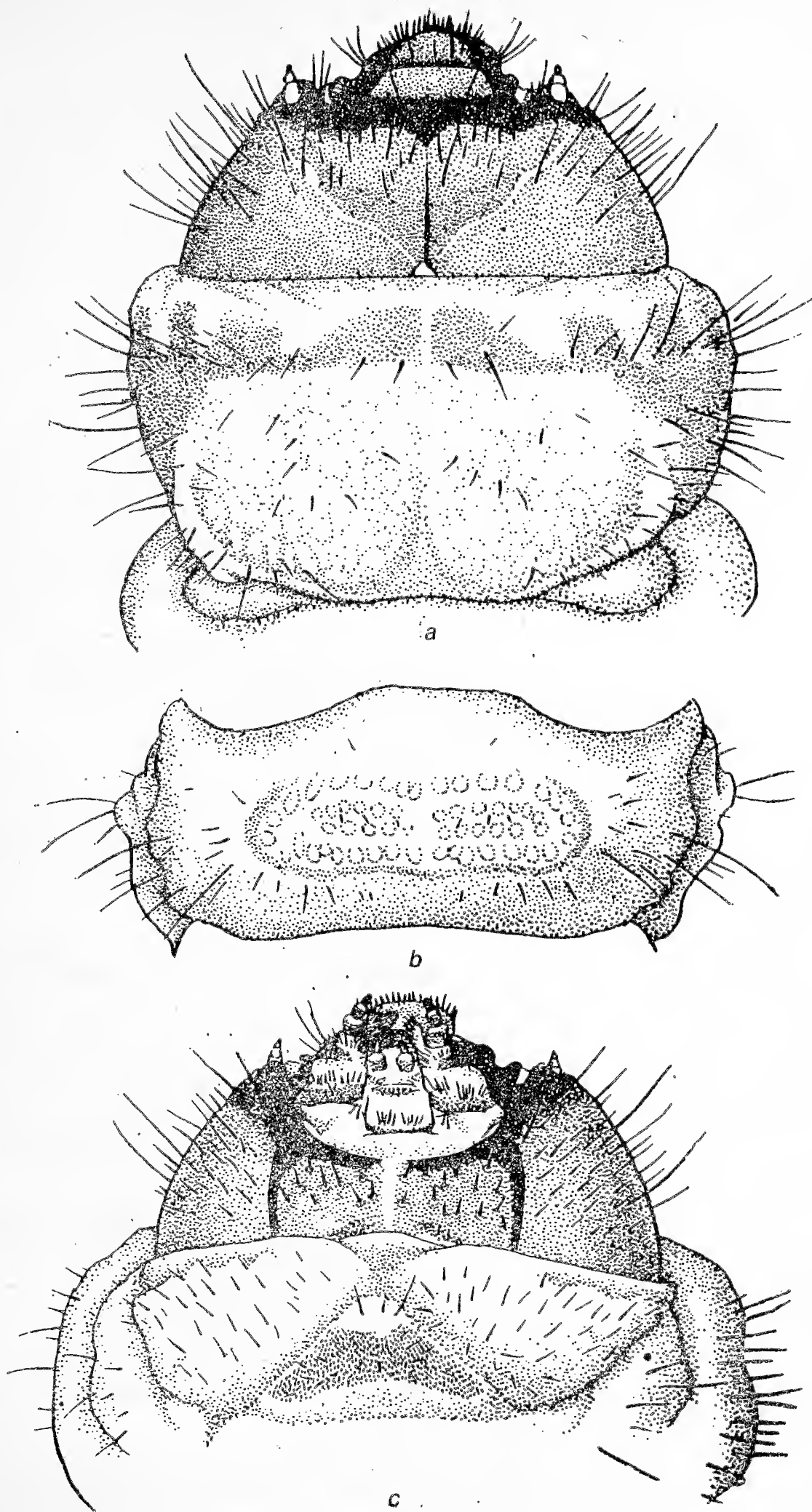


Figure 231. Larva of *Leptura quadrifasciata* L.
 a—head and pronotum; b—abdominal tergite with locomotory
 ampulla; c—head and prothorax (ventral view).

mainly in anterior half, and narrow, sometimes broader longitudinal white gula medially. Clypeus 3.0 times wider than long, white, with narrow brownish border at base. Labrum brownish-rust, whitish only on anterior margin, with six setae behind middle forming transverse row, and dense setae along margins. Mandibles insignificantly elongate, taper gently at apex, with projecting lower denticle, and narrow transverse projection on outer side anterior to middle.

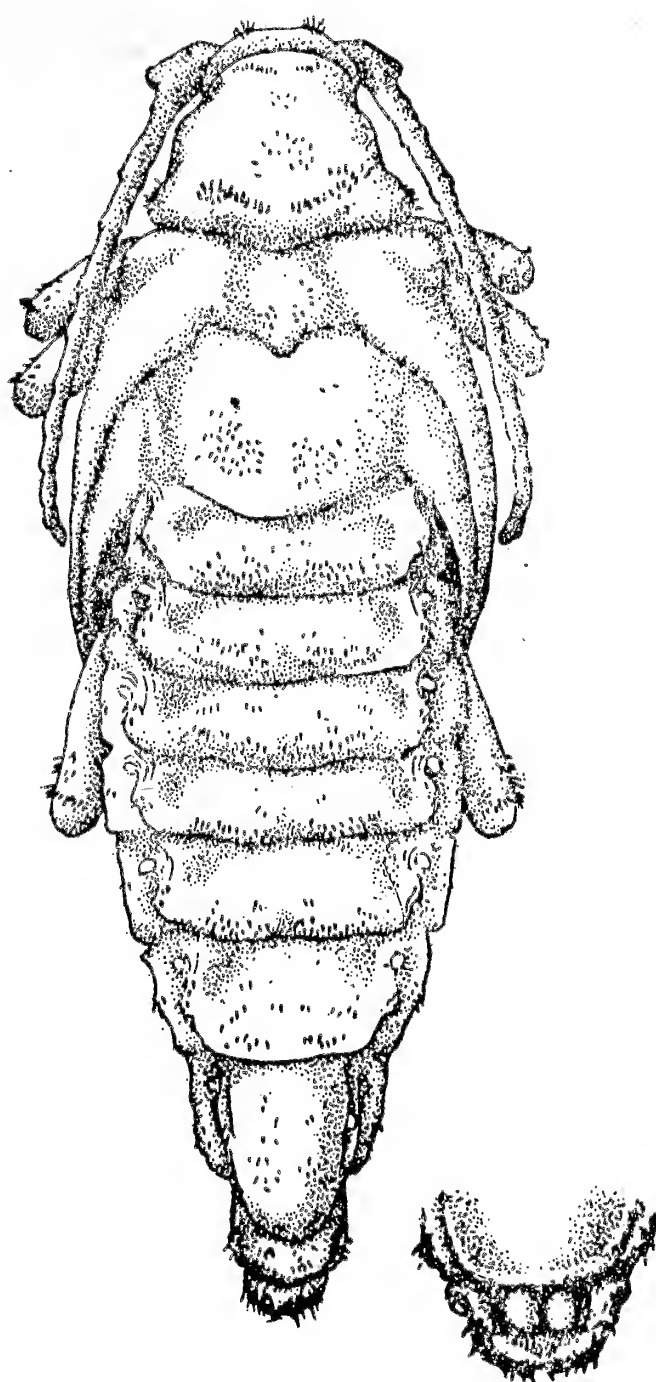
Pronotum transverse, with almost parallel sides; in anterior half with not very broad, laterally on anterior margin with emarginate (three places) yellowish-rust transverse band, and sparse short setaceous hairs on disk. Pronotal shield bulges notably, striate, usually white, elongate anteromedially and at angles, and hence appears to have two emarginations anteriorly; short setaceous hairs on anterior margin form curved transverse row. Eusternum with very dense hairs in anterior half, broad transverse sclerotized band in middle consisting of minute brownish spinules.

Dorsal locomotory ampullae developed on abdominal tergites I to VI, bulge, divided by narrow median longitudinal groove with four rows of granules; inner rows of granules proximate, sometimes partly indistinct. Abdominal tergite VII smooth, without locomotory ampullae, with short sparse hairs. Ventral locomotory ampullae well developed
 363 on abdominal sternites I to VI and with two rows of granules. Sternite VII with faint transverse band and sometimes small granules. Body length of mature larvae up to 32 mm, width of head up to 4.5 mm.

Pupa (Figure 232): Readily recognized by urogomphi at tip of abdomen and arrangement of spinules on pronotum. Head markedly narrows anterior to antennae. Frontal tubercles at base of antennae raised, usually with numerous spinules forming longitudinal tuft. Frons along anterior margin with paired lateral spinules forming transverse row, sometimes third pair of spinules between them. Head laterally rounded behind eyes, usually with large spinules directed inward. Antennae short, arcuate, flexed to sides.

Pronotum narrows anteriorly, with small anterior flange, produced posterior angles, bulging disk with transverse striation; with various (long and very short) diffuse spinules forming extensive field, long acicular spinules on posterior margin set on protuberant coriaceous base and forming transverse row interrupted medially. Mesonotum with minute stray spinules. Metanotum bulges, in posterior half with short acute conical spinules forming two round tufts.

Abdomen elongate, barely narrows toward base, but markedly though gradually toward tip. Abdominal tergites bulge, with median longitudinal groove, short acute spinules in posterior half directed backward and forming transverse, sometimes indistinct row intercepted medially



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Figure 232. Pupa of *Leptura quadrifasciata* L., female.

by broad clearance of longitudinal groove. Tergites with minute diffuse specklike spinules in anterior half. Tip of abdomen with pair of urogomphi terminating in sclerotized spinules, bent dorsally and slightly laterally. Valvifers of female hemispherical, contiguous, with lateral papilliform projection at apex. Length of body 19 mm, width of abdomen 5.0 mm.

Material: From Altai, Ob' region and Tuva. Adult insects 1,045, including 119 raised in the laboratory, larvae 139, pupae—three males and three females.

Distribution: Covers almost the entire Palearctic, including northern Asia and the Urals, western Siberian lowland, northern Kazakhstan, Altai, eastern Siberia, Ussuri-Primor'e region, and Sakhalin; northern Mongolia, northern China, Korea, and Japan.

Biology: Inhabits deciduous and mixed forests. Highly numerous in plains and foothill regions. Extends in mountains up to 2,000 m above sea level. Flight of beetles commences mainly in June and ends mid-August. Flight of greater part of population in July. For example, of 912 beetles collected over a long period, 0.1% were found end of May, 5.3%—June, 78.8%—July, and 15.8%—August. In mountains at a height of 1,000 to 2,000 m, commencement of flight is shifted to end of June—early July. Beetles avidly feed on flowers of Rosaceae (*Spiraea*, *Filipendula*, *Rosa*), Umbelliferae (*Heracleum*, *Aegopodium*, *Archangelica*), Ranunculaceae (*Paeonia*), and other plants.

Female lays eggs under scale of bark and in wood fissures of stumps and fallen and standing dead deciduous trees. I found this species on birch, aspen, and mountain ash. More often sighted on trunks of birch and aspen damaged by rot. Ovaries of one female taken from pupal cell contained 137 fully mature eggs, of another 100. This would indicate comparatively high fecundity. Beetles feed more than once. After laying a batch of eggs, female returns to flowers to feed again. Larvae hatch three to four weeks after oviposition. In a Kuzedeevsk linden grove near Salair at a mean daily atmospheric temperature of 16.4°C, embryonic development took 21 to 32 days, average 25.4 days. In a forest on the bank of Lake Telets 496 eggs were kept under observation; their development continued for 18 to 30 days, average 24.9 days. Atmospheric temperature during this period varied from 5.2 to 27.4°C (average 18.5°C).

Larvae break the chorion during hatching and immediately bore into wood where they make galleries along the trunk and plug them behind with fine frass. After third hibernation, with the onset of warmer weather, they make a cell at end of gallery and pupate in it. Width of galleries made by mature larvae reaches 18 mm. Length of pupal cell 27 mm, width 10 mm or more. Pupae develop in two to three weeks. One week later young beetles nibble round openings 5.0 to 8.0 mm in diameter later on trunk surface and emerge through them. Emergence of beetles from wood commences in early June and ends in July. Weight of larvae before pupation 168.5 to 515.0 mg, pupae 105 to 403 mg, and young beetles 79 to 310 mg. Weight reduction during metamorphosis is exemplified by 10 insects raised on wood in the laboratory. Total weight of larvae ready for pupation 3,745.5 mg (100%), pupae developed from them 2,857 mg (76.2%), and young beetles after emerging from wood 2,106 mg (56.2%). *Leptura nigripes* Deg., *L. melanura* L., more rarely *Necydalis major* L., and others colonize the same trees together with this species.

9. *Leptura arcuata* Panz.

Panzer, 1873, *Fauna Ins. Germ.*, vol. 7, p. 524; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 428-430 (*Strangalia*); Gressitt, 1951, *Longicorn Beetles of China*, vol. 2, pp. 97-98; Kojima and Hayashi, 1969, *Insect Life in Japan*, vol. 1, pp. 32-33; Cherepanov and Cherepanova, 1975; *Zhuki-drovoseki ivovykh lesov Sibiri*, pp. 72-76 (*Strangalia*).

Adult (Figure 233): Well distinguished by pattern of elytra. Body elongate. Head long, sharp flange behind temples, large dense punctation on frons and vertex, with short golden hairs, and median longitudinal suture between antennae. Temples short and rounded, with long dense hairs forming small brush. Eyes large, bulge, slightly emarginate. Antennae thin, with apices reaching third band on elytra (female) or extending beyond it (male).

Pronotum campanulate, roundly bulges on disk, broadens toward base, markedly narrows anteriorly, with posterior angles produced laterally, flange on anterior margin, transverse groove basally, sometimes with narrow median longitudinal bond, with dense even punctation, and dense adherent golden hairs that are denser at base. Scutellum triangular, elongate, with pointed apex.

Elytra in female less, in male more elongate, narrow toward apex, obliquely notched apically with projecting outer angles, with dense notched punctation and semiadherent short hairs. Legs comparatively long; hind tibiae in male curved, in female straight. Body black; antennae basally black, light rust toward apex from 3rd to 5th segment, sometimes entirely rusty. Elytra straw-yellow; narrow band along suture encircling base and extending to humeral tubercles, three transverse bands, and apex black. Anterior band arcs anteriorly and protudes on disk and sides. Middle band continuous, with interception on suture or interrupted on disk, rounded around suture in form of two patches. Posterior band even or narrows slightly on suture. Sometimes these bands
365 are so enlarged that small yellow spots remain in general black background. Legs black, tibiae rusty, sometimes entirely rusty or black. Length of body 13 to 20 mm.

Egg: White, elongate, rounded at poles, sometimes narrower toward one end; with five- or six-faceted cells with thin septa between them. Length 2.0 mm, width 0.6 mm.

Larva (Figure 234): Close to larva of *Leptura quadrifasciata* L. in sclerotized eusternum and structure of pronotum. Differs in number of setae on hypostoma and structure of locomotory ampullae. Head narrowly rounded anteriorly. Epistoma even, not impressed in posterior half, pointed apically, demarcated laterally by straight frontal sutures, with well-developed brownish-cinnamon longitudinal suture somewhat obliterated in anterior half, without perceptible whitish transverse band

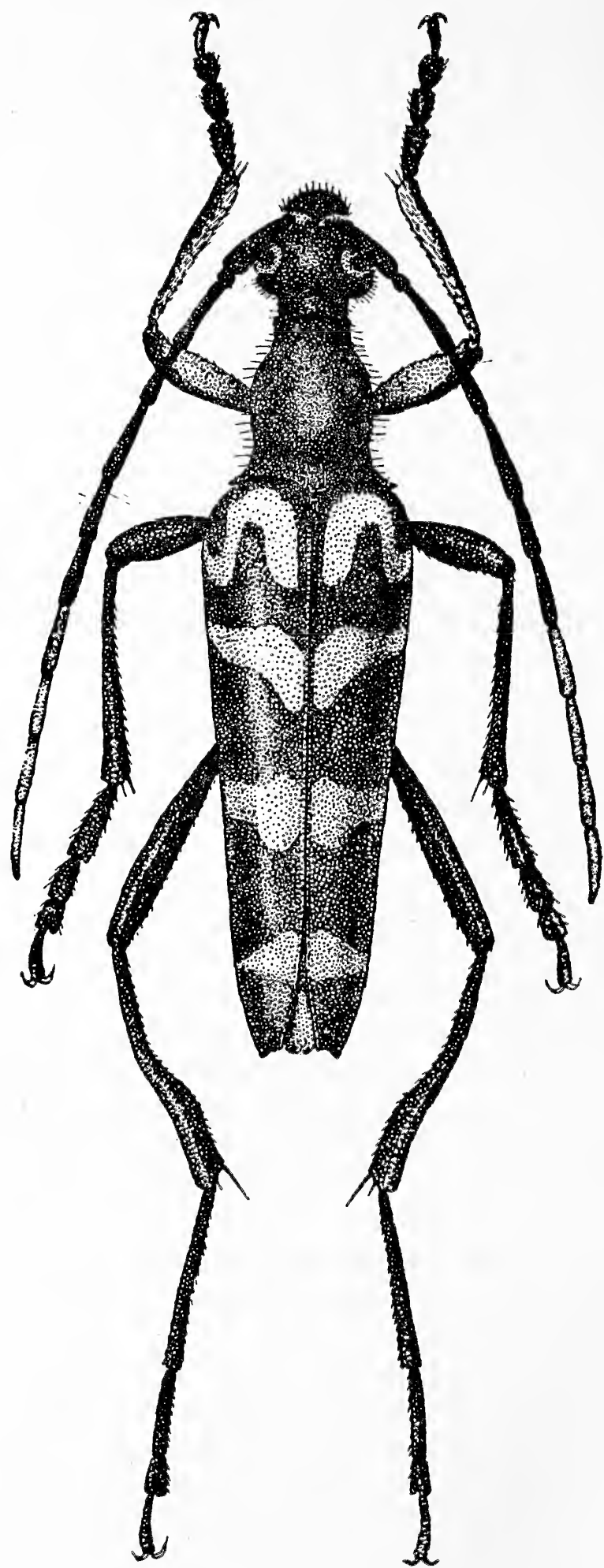


Figure 233. *Leptura arcuata* Panz.

anterior to middle. Hypostoma slightly narrows anteriorly or perceptibly rounded laterally, with narrow white gular band in middle, with a few setae (six to nine on each side) laterally in anterior half forming one to two indistinct transverse rows. Clypeus short, width 3.0 times length, white, trapezoidal. Labrum transversely oval, bulges, whitish, glabrous on disk, with dense short setae along margins, brownish at base and here with long and short setae (up to 10) forming transverse row. Mandibles gently notched apically, with elongate lower denticle.

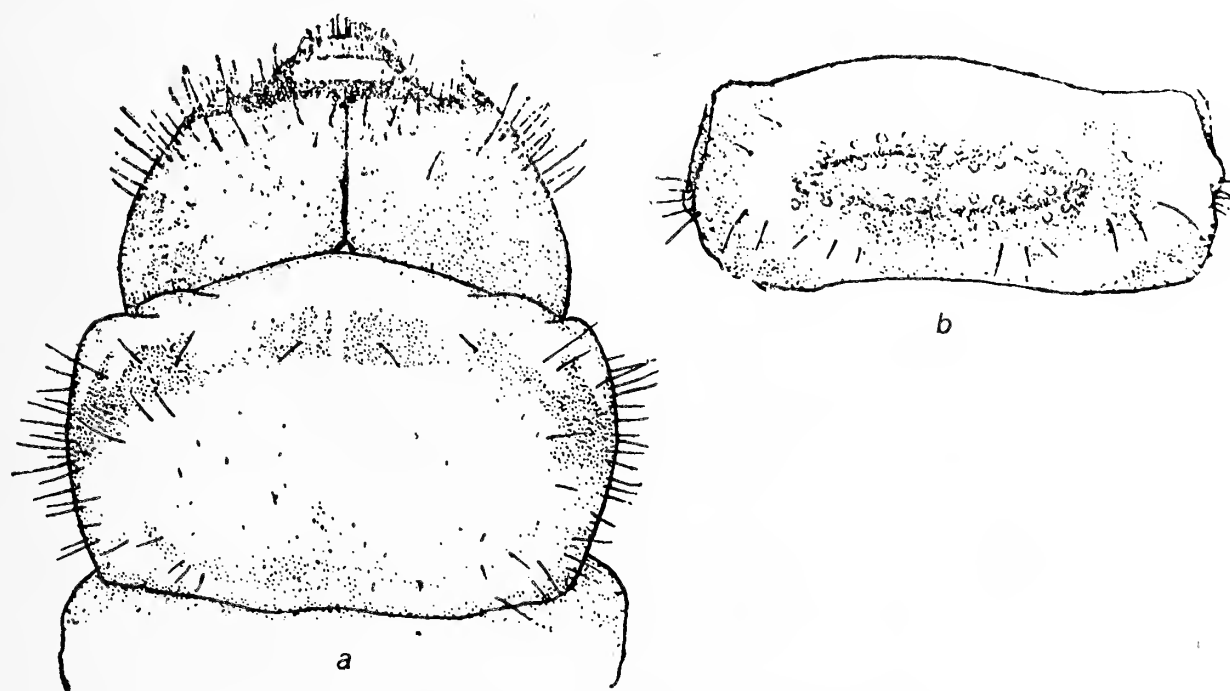


Figure 234. Larva of *Leptura arcuata* Panz.
a—head and pronotum; b—abdominal tergite
with locomotory ampulla.

Pronotum transverse, slopes toward head, disk with short thick hairs, sides with long, thin, setaceous, uniformly dispersed hairs. Pronotal shield distinct, bulges, striate, in mature larvae with rusty tinge; with two emarginations on anterior margin and angularly produced anteromedially. Eusternum sclerotized, with minute spinules forming narrow band only at anterior and posterior borders, coriaceous, lustrous, without spinules but with setaceous hairs in anterior half, of which three to four disposed on coriaceous lustrous anterior border, and remainder on sclerotized section. Anterior clivus of thoracic sternites between legs and also anterior half of meso- and metanota with minute brownish spinules.

Abdomen gradually narrows posteriorly, with sparse hairs laterally. Dorsal locomotory ampullae well developed on abdominal tergites I to VI, with four rows of granules forming two ellipse insignificantly extending transversely. Locomotory ampulla on tergite VII in form of faintly

granulate transverse band. Anterior margin of dorsal ampulla (anterior to front row of granules) with minute spinules, at places visible only under high magnification. Ventral locomotory ampullae with two rows of granules—on anterior margin (in front of granules) and on posterior margin (behind posterior row of granules) with minute brownish spinules. Locomotory ampulla on sternite VII in form of more or less granulate transverse carina, with minute spinules in front forming narrow brownish band. Body white. Head rusty, anterior margin of epistoma black. Mandibles black. Anterior half of pronotum with narrow yellowish-rust transverse band; anterior margin with three emarginations on each side. Body length of mature larvae 20 to 27 mm, width of head 3.5 mm.

Pupa (Figure 235): Similar to that of *Leptura quadrifasciata* L. Easily distinguished from it by pair of spinous tubercular protuberances at base of metanotum. Body elongate. Head narrows markedly
367 anterior to antennae, frontal tubercles at base of antennae not distinct; with numerous spinules forming longitudinal tufts, and paired spinules laterally on anterior margin. Occipital protuberances behind eyes rounded, not prominent, with short spinules forming two broad disconnected tufts. Antennae curve steeply, almost annular.

Pronotum narrows anteriorly, with two emarginations at base; comparatively long acicular spinules on posterior upright margin form transverse band interrupted medially by longitudinal groove; minute spinules on disk form small tuft; perceptible flange anteriorly; spinules on anterior, sometimes raised margin form transverse row or small tuft extending longitudinally. Mesonotum bulges, transversely striate, with one tuft of fine spinules on each side. Metanotum with small transverse stripes on disk, longitudinal groove, and pair of tubercular protuberances in posterior half covered with short acute spinules (15 to 20).

Abdomen more (male) or less (female) elongate. Abdominal sternites behind middle with acute spinules directed backward, set on protuberant coriaceous base, forming two transversely extended tufts widely intercepted medially by longitudinal groove. Tip of abdomen dorsally with pair of urogomphi turned lyrate dorsally, laterally, and anteriorly. Valvifers of female hemispherical, large, produced laterally at apex. Length of body 20 to 23 mm, width of abdomen up to 5.0 mm.

Material: From eastern Ural region, Ob' region, Altai, Tuva, and Ussuri-Primor'e region. Adult insects 3,162, including 150 raised in the laboratory, larvae 65, pupae—four males and two females.

Distribution: Occupies forest and forest-steppe zones of Eurasia. Extends in northern Asia from the Urals to Pacific Ocean coast from forest-tundra to Altai; northern Mongolia, northern China, Korea, and Japan.

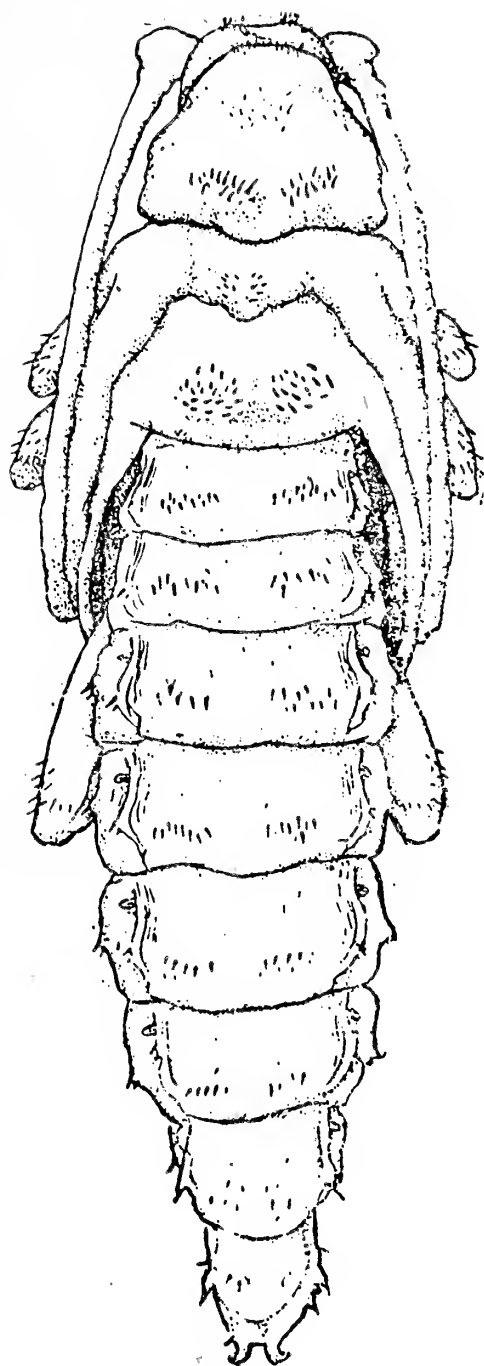


Figure 235. Pupa of *Leptura arcuata* Panz., male.

Biology: *Leptura arcuata* Panz. inhabits deciduous and mixed forests. Ecologically associated mainly with deciduous wood species, rarely with conifers (fir and others). The earlier assumption that this species colonizes only coniferous wood species (Plavil'shchikov, 1936, 1955) should be considered erroneous. Flight of beetles from end of May through August. Found maximally end of June and in July. In Altai over a period of three years about 1,800 beetles were collected in the forest. These included 0.1% found in May, 23.8%—June, 71.8%—July, and 4.3%—August. Beetles seen on flowers gathering pollen. Active in clear warm weather. Female lays eggs in bark crevices at some distance from each other. Laid eggs initially white, turn pinkish in three to four days. According to observations made in Salair, embryonic development in

the forest at a mean daily temperature of 18.5°C took, on the average, 20.9 ± 0.2 days. Some eggs developed in 27 days in shade but in just 16 days in places warmed by sun. Larval hatching in 1968 in Salair commenced on July 15 and ended mid-August. En masse hatching was recorded in second half of July. Larvae initially live under bark of dead trees, later bore into wood, make longitudinal galleries there, and plug them with frass. Sometimes found in rotten wood.

Mature larva makes cell at end of gallery along trunk. Length of cell 17 to 28 mm, width 8.0 to 9.0 mm. Pupation commences early May and ends in June. Pupae found in middle 10 days of July. Young beetles develop in three weeks and five to six days later nibble round openings on trunk surface and emerge through them. Emergence of beetles from wood commences end of May and ends mid-July. Most beetles
368 abandon wood toward end of June, but in high-altitude regions only in first half of July. Development from egg to adult completed in two to three years. Weight of prepupae 121 to 365 mg, pupae 110 to 332 mg, and beetles 87 to 266 mg.

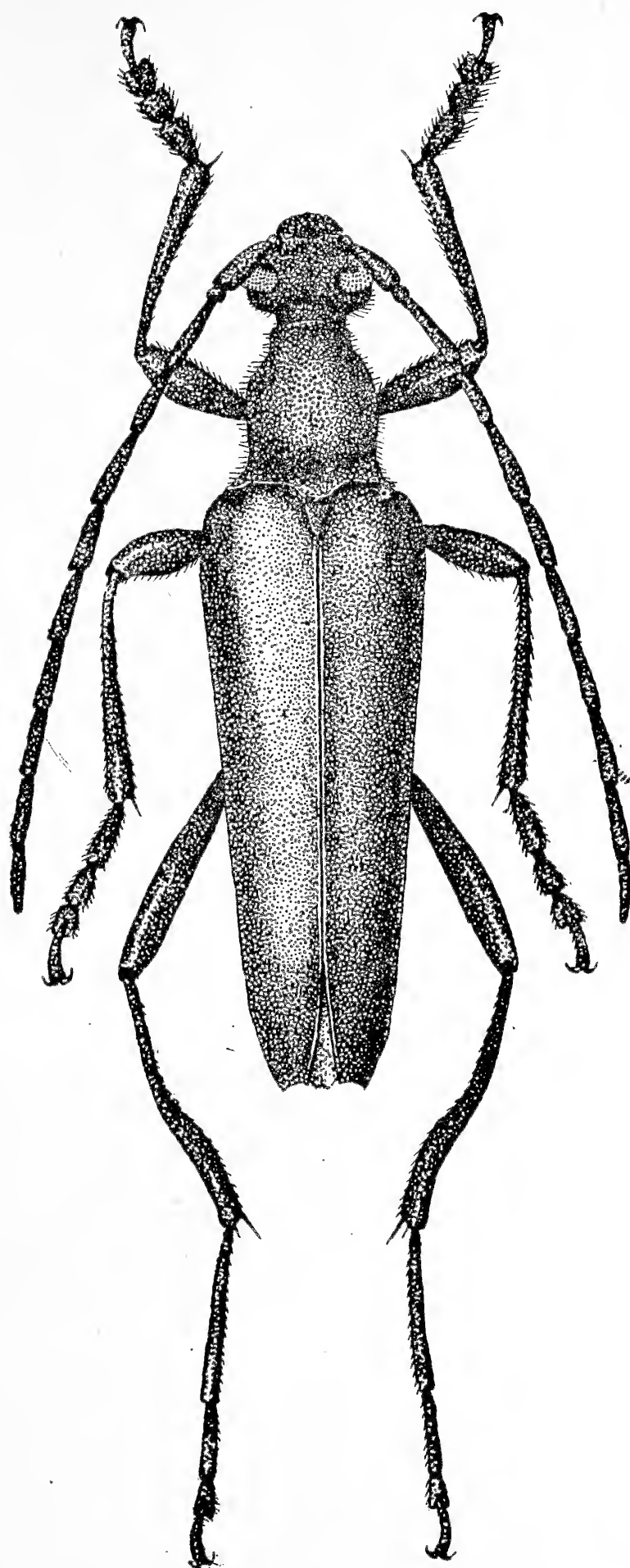
Leptura arcuata Panz. inhabits trees of many species. I raised beetles from larvae found on willow, birch, linden, alder, oak, maple, bird-cherry, fir, and others. Develops on fallen and standing dead trees. Often found on rotten stumps. Larvae found in trunk of birch undergrowth up to 4.0 cm in diameter and 3.6 m in height. Population density significant. In a bird-cherry cutting 28 cm long and 25.7 cm in diameter, I found 19 beetles, one pupa, and four prepupae.

10. *Leptura aethiops* Poda

Poda, 1761, *Ins. Mus. Graec.*, p. 38; *dimorpha*, Bates, 1873, *Ann. Mag. Nat. Hist.*, 12, 4, 195; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 433-435 (*Strangalia*); Gressitt, 1951, *Longicorn Beetles of China*, vol. 2, p. 96.

Adult (Figure 236): Readily recognized by curved hind tibiae in male, color of elytra, and combination of other features. Head with minute close punctation, narrow median longitudinal suture, and sparse, barely perceptible hairs (thus appears glabrous). Temples short, with long dense erect hairs. Antennae comparatively long, extend beyond 0.66 or 0.75 length of elytra (female) or just short of reaching elytral apex (male).

Pronotum more (male) or less (female) elongate in anterior third, with narrow flange at anterior margin, transverse groove at base, acutely produced posterior angles, bulges on disk; with distinct round very dense punctation, narrow smooth band in middle, and fine hairs not forming general cover. Scutellum small, elongate, pointed and black apically, with minute adherent hairs.



Elytra elongate, more (male) or less (female) narrow posteriorly, 369 notched apically, angles insignificantly produced, longitudinally impressed at base near humeri; with minute close notched punctation forming thin transverse wrinkles and fine partly semiadherent hairs. Legs slender, comparatively long; hind tibiae in male curved, appear notched on inner side, straight and slender in female. Hind tarsi not shorter than tibiae; 1st segment longer than all successive ones together.

Abdominal sternite V bulges slightly or flat, without sharp impression (f. *typica*) or with sharp longitudinal impression extending from 370 anterior to posterior margin (ssp. *dimorpha* Bat.). Body, antennae, elytra, and legs black. Sometimes elytra brownish or brownish-red (*m. adustipinnis* Sols.). Length of body 11 to 15 mm.

Egg: White, elongate, narrows toward ends, rounded at poles. Chorion with large uneven cellular sculpture: spaces between cells thin, distinct. Length 1.9 mm, width 0.6 mm.

Larva (Figure 237): Characterized by locomotory ampullae on first seven abdominal segments and incomplete sclerotization of eusternum. Head slightly narrows anteriorly, long setaceous hairs laterally on anterior half. Epistoma behind middle insignificantly impressed. Longitudinal suture of epistoma well developed only in posterior half (closer to apex), less so in anterior half, appears obliterated there. Hypostoma narrows anteriorly, with almost straight lateral sutures, flat, with narrow white gula, in anterior half with setae forming two indistinct transverse rows. Clypeus markedly narrows anteriorly; with whitish or brownish coloration. Labrum broadly rounded and with short dense setae along anterior margin, bulges and glabrous on disk, with stray erect setae at base in transverse row.

Pronotum gently rounded at base, slightly broadens anteriorly, with transverse yellowish band in anterior half interrupted medially by narrow white clearance with three almost rectangular deep notches on each side of clearance along anterior margin. Pronotal shield bulges, white, coarsely striate. Eusternum bulges, with sparse setaceous hairs in anterior half and transverse sclerotized band in middle; this band so enlarged in some specimens that it covers greater part of eusternum.

Abdomen laterally with sparse short hairs. Dorsal locomotory ampullae bulge, oval, slightly extended transversely, with minute granules; middle rows of granules proximate with minute spinules between them; short setae, with four on each side of longitudinal groove. Dorsal locomotory ampulla on tergite VII with two rows of granules without sclerotized spinules. Ventral locomotory ampullae well developed on abdominal sternites I to VII, with granules forming two parallel transverse rows on each sternite, and barely perceptible sclerotized band on

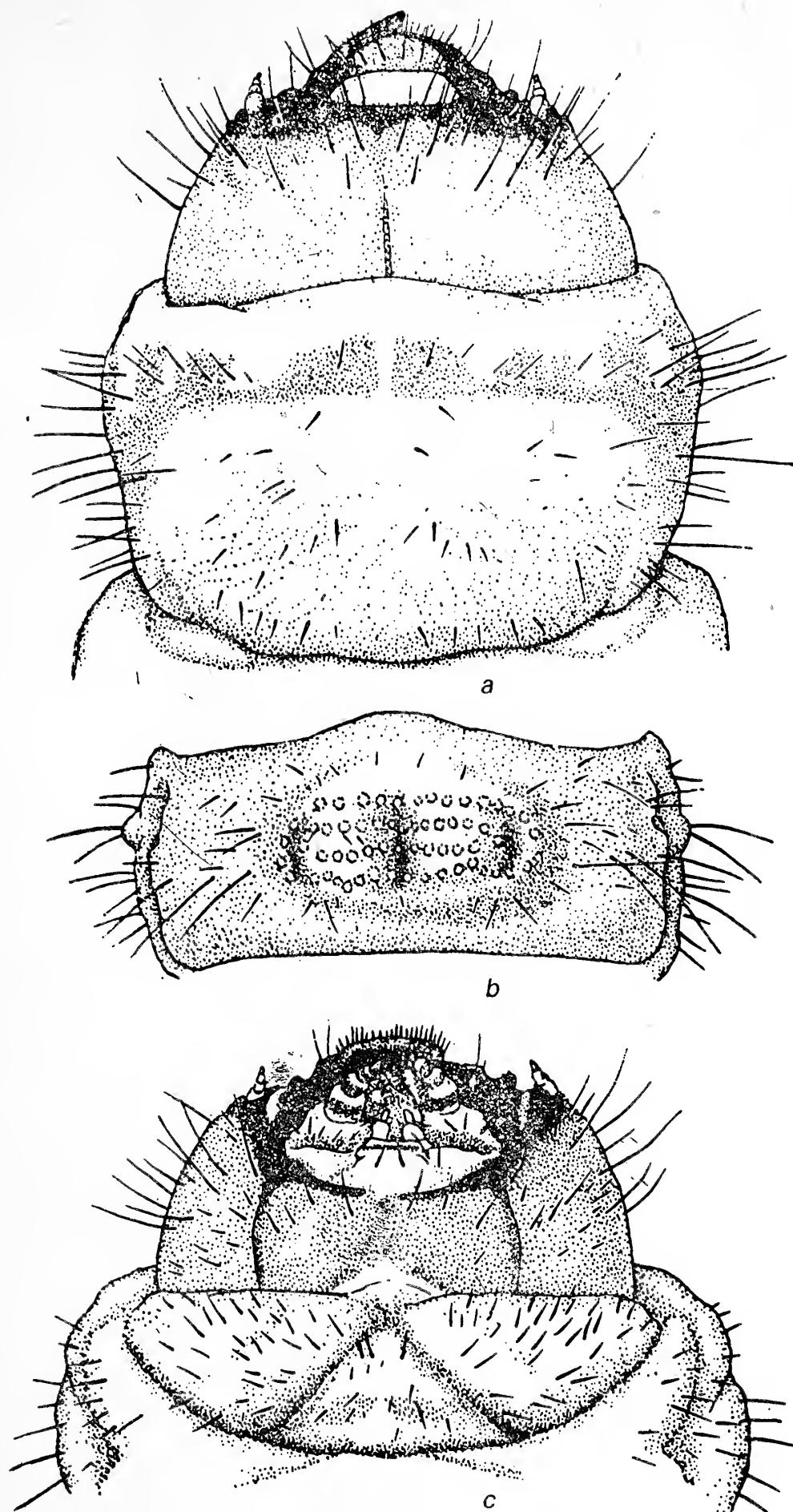
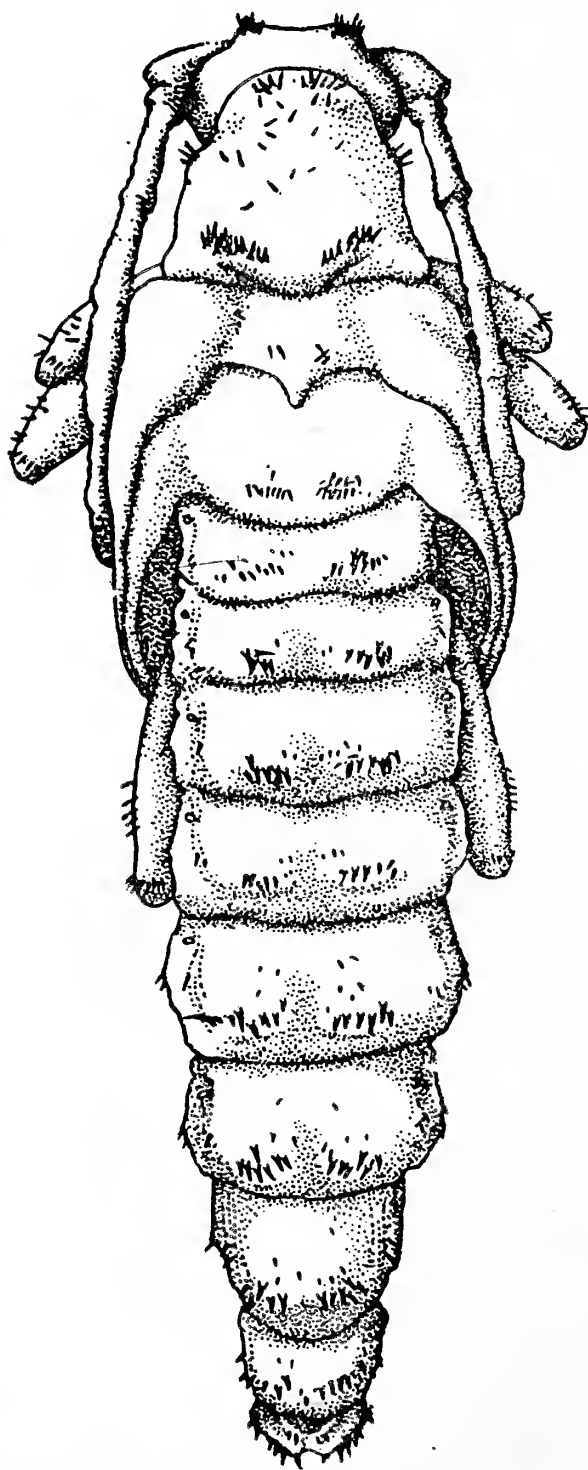


Figure 237. Larva of *Leptura aethiops* Poda.

a—head and pronotum; b—abdominal tergite with locomotory ampulla;
c—head and prothorax (ventral view).

anterior and posterior margins consisting of very fine spinules visible only under high magnification. Length of body 25 mm or more, width of head up to 3.5 mm.

Pupa (Figure 238): Body elongate. Head bulges slightly transversely between antennae and here with long acicular spinules along sides forming longitudinal band; gently impressed between upper lobes of eyes. Anterior margin of frons with six spinules forming transverse row turned upward. Occipital protuberances behind eyes along sides of head rounded, with thin acicular spinules forming longitudinal band.



Pronotum elongate, with small flange anteriorly, acute spinules on anterior margin forming tuft intercepted medially by narrow clearance, bulges on disk; thin acute spinules in anterior half of sloped clivus, impressed in middle of base with raised upright margins of impression bearing subulate spinules (10 to 12 each) forming indistinct row that turns from middle laterally and slightly anteriorly. Mesonotum bulges, with two to three lateral spinules. Metanotum basally with subulate spinules set on protuberant coriaceous base forming two compact tufts (14 to 16 spinules per tuft).

- 371 Abdomen narrow, gradually narrows posteriorly. Abdominal tergites bulge, with large acute subulate spinules in posterior half forming transverse row or band interrupted medially by longitudinal groove; minute acicular dispersed spinules in front of this band. Tip of abdomen rounded dorsally, without urogomphi, with numerous spinules along margin; obtuse ventrally, bound laterally by carina set with acicular spinules. Abdominal sternites without spinules. Length of body 16 mm, width of abdomen 3.0 mm.

Material: Collected in Altai, Tuva, Ussuri-Primor'e region, and Kunashir. Adult insects 412; larvae 51, pupa—one male.

Distribution: Covers almost the entire Palearctic from Atlantic to Pacific Ocean coasts. In northern Asia extends into the Urals, western Siberian lowland, northern Kazakhstan, Altai, Tuva, Baikal region, Trans-Baikal, Ussuri-Primor'e region, Sakhalin, Kunashir and Shikotan; northern Mongolia, northern China, Korea, and Japan.

Biology: Found in mixed and deciduous forests. Flight of beetles commences early June and continues up to mid-August. En masse flight recorded in second half of June and first half of July. For example, during systematic collections of every 100 beetles found, eight were found in first half of June, 55—second half of June, 35—first half of July, one—second half of July, and one—first half of August. Beetles feed avidly on flowers of Rosaceae (*Spiraea*, *Sorbaria*, and others). Umbelliferae (*Aegorodium*, *Heracleum*, *Bupleurum*), Compositae (*Achillea*, *Matricaria*), Ranunculaceae (*Trollius*, *Paeonia*), and other plants. Female lays eggs on thin trunks of deciduous and rarely coniferous wood species in basal zone. Ovaries of one female picked from flowers contained 32 eggs, of another female just emerging from wood 36 eggs. Oviposition mainly completed in July. In 1968 under a gently sloping forest in Salair at a mean daily temperature of 18.9°C, egg development took 16 to 35 days, average 21.5 days (67 eggs kept under observation).

On hatching larvae bore into bark, make galleries along trunk initially under bark, later upward in wood, and plug them with fine frass. Cell made at end of gallery and larva pupates in it with head

upward; cells disposed along or oblique to trunk surface. Length of cell 20 to 35 mm, width 7.0 to 8.0 mm. Width of gallery before cell 8.0 mm.

Pupation commences in May and ends in June. Developed beetles nibble round openings up to 4.0 to 5.0 mm in diameter on trunk surface and abandon pupal cell through them. Emergence of beetles from wood completed in June and July. Weight of larvae before pupation 92 to 142 mg, pupae 83 to 128 mg, and beetles before emerging from wood 67 to 102 mg. I raised beetles of this species from larvae collected from birch, hornbeam, Manchurian striped maple (*Acer tegmentosum*), oak, alder, lilac, and Japanese stone pine (*Pinus pumila*). Mainly colonizes thin-trunked dead trees about 3.0 to 6.0 cm in diameter. Larvae quite often found in wood damaged by rot; detected on larch.

11. *Leptura duodecimguttata* (F.)

Fabricius, 1801, *Syst. Eleuth.* p. 356 (*Strangalia*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 432-433 (*Strangalia*); Gressit, 1951, *Longicorn Beetles of China*, vol. 2, p. 96; Kojima and Hayashi, 1969, *Insect Life in Japan*, vol. 1, p. 31; Cherepanov and Cherepanova, 1975, *Zhukidrovoseki ivovykh lesov Sibiri*, pp. 76-79 (*Strangalia*).

Adult (Figure 239): Easily recognized by pattern of spots on elytra. Body of female very broad, of male elongate. Head turned anteroventrally, with sharp flange behind eyes; dense round punctation on frons, vertex, and occiput; temples short, with long dense hairs. Cervix comparatively long, closely punctate. Eyes insignificantly emarginate. Antennae widely separated, with apices in female extending just beyond 0.50, in male 0.66 length of elytra.

Pronotum slightly longer than width at base, narrows anteriorly, with or without narrow transverse groove at apex, bulges, with dense even punctation, and uniform light-colored hairs directed backward. Scutellum triangular, not longer than width at base.

Elytra in female broad, bulge at humeri, in male narrow and elongate, insignificantly narrow posteriorly, narrowly notched apically, with projecting posterior angles, with dense rugose notched punctation and semiadherent short hairs. Legs moderately long; femora thicken insignificantly, hind tibiae in male notably curved. Body black. Antennae black, matte with white tinge from 6th segment. Elytra black, with yellowish light-colored spots, of which pair of elongate oblique spots at base behind scutellum, two pairs of triangular spots before middle, two pairs of similar spots behind middle, and one pair of transversely elongate spots in posterior third near apex. Sometimes middle pairs of spots fuse and form transverse band, and sometimes reduced so much they resemble individual light-colored punctures. Length of body 10 to 16 mm.

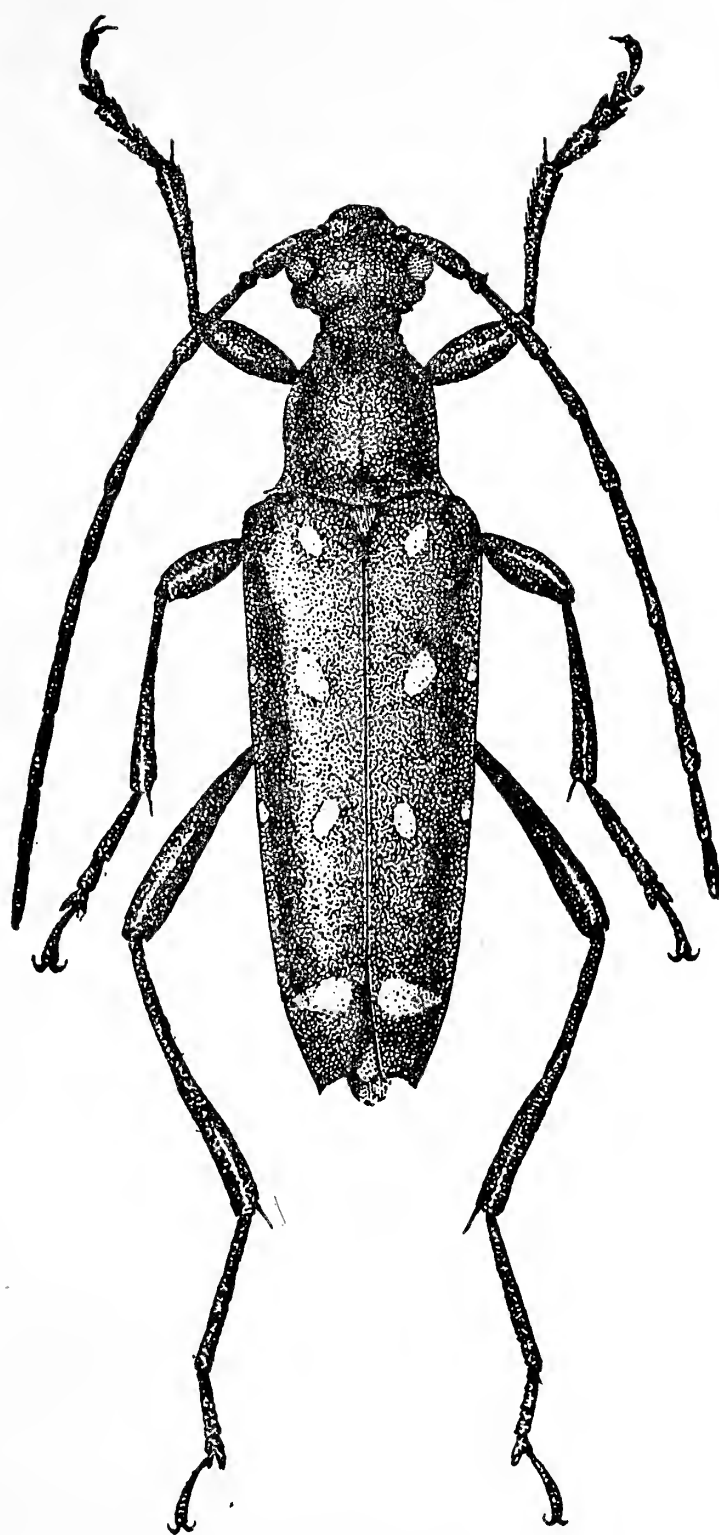


Figure 239. *Leptura duodecimguttata* (F.).

Egg: White, with yellow tinge, gradually narrows more steeply toward one end, narrowing less toward the other, narrowly rounded on one pole, and obtusely at the other. Chorion with sharp deep cellular sculpture. Cells uniform, five- or six-faceted; spaces between them thin and white. Length 1.8 to 2.0 mm, width 0.6 mm.

Larva (Figure 240): Very similar to larva of *Leptura arcuata* Panz. in sclerotization of eusternum, structure of hypostoma, and other features. Differs in epistoma broadly impressed in posterior half. Half

of head retracted into prothorax: sides of anterior half of head with dense hairs. Epistoma notably impressed in posterior half, without whitish diffuse transverse band before middle, blackish-brown on anterior margin. Longitudinal suture dark brown, distinct. Perceptible curvature at apex. Hypostoma slightly narrows anteriorly, with narrow white median longitudinal band, sometimes barely perceptible; with five to eight lateral setae in anterior half, of which inner ones proximate to anterior margin, lateral ones shifted closer to posterior half.

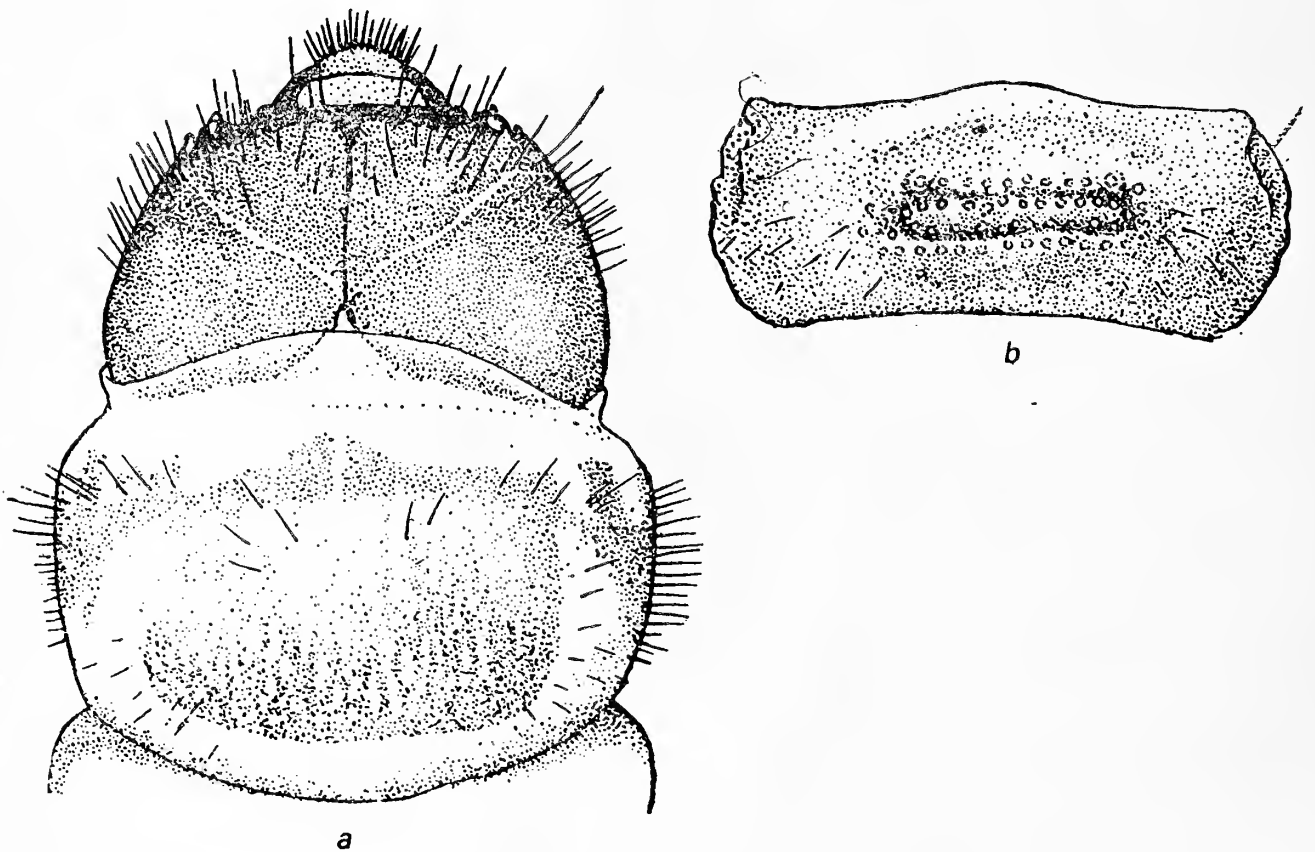


Figure 240. Larvae of *Leptura duodecimguttata* (F.).

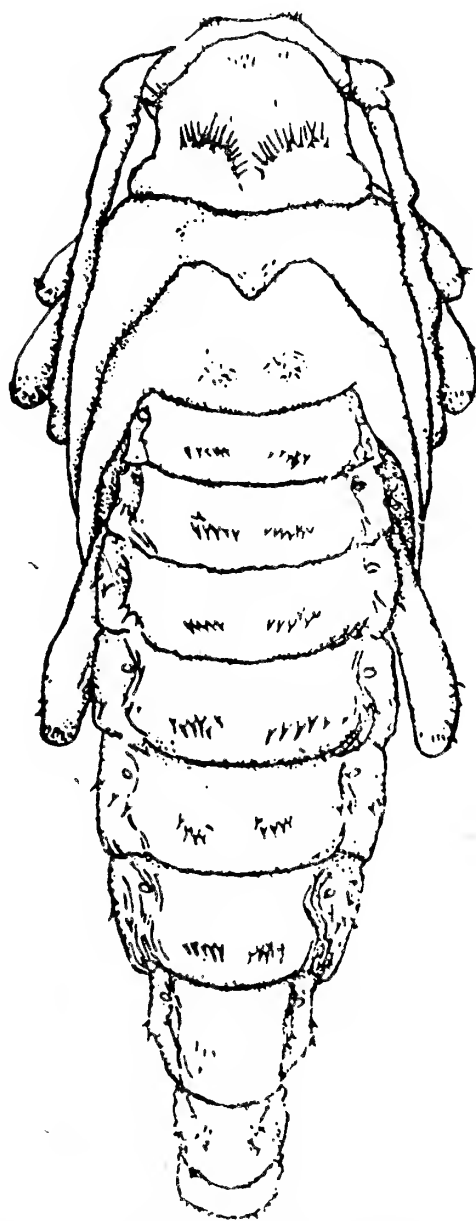
a—head and pronotum; b—abdominal tergite with locomotory ampulla.

Pronotum laterally shortened as though transversely oval, with transverse yellow band in anterior half interrupted medially by narrow white longitudinal clearance, short dispersed hairs on disk, and much longer fine hairs laterally. Pronotal shield bulges, striate, white, lustrous, sometimes in mature larvae brownish-yellow, and slightly produced anteromedially on anterior margin. Eusternum sclerotized, with dense minute brownish spinules, coriaceous and lustrous only at anterior and posterior margins (in form of narrow transverse border). Nonsclerotized anterior margin with three to five hairs and sclerotized part of eusternum with up to 10 to 14 hairs.

Dorsal locomotory ampullae developed on abdominal tergites I to VI, with granules forming four transverse rows, usually with distinct

transverse sclerotized carina between inner rows of granules; with two sclerotized fields, of which one before anterior row and second behind posterior row of granules. Dorsal locomotory ampulla of tergite VII barely developed as small transverse band. Ventral locomotory ampullae divided by transverse groove, with two rows of granules and two sclerotized transverse bands (in anterior and posterior halves of sternite). Lower anal lobes with sparse setae. Length of prepupa 20 to 25 mm, width of head 3.6 mm.

Pupa (Figure 241): Readily distinguished from pupa of closely related species (*Leptura arcuata* Panz.) in absence of long urogomphi at tip of abdomen (female) and arrangement of spinules on pronotum. Head between antennae bulges transversely, with innumerable minute spinules at base of antennae forming longitudinally elongate tuft (male), or with a few large (five or six) spinules forming indistinct longitudinal



row (female). Frons on anterior margin with four to six spinules forming transverse row; occipital protuberances with stray small spinules (female) or spinules for sparse group (male). Antennae arcuate (female) or almost annular (male), flexed to sides.

Pronotum elongate, narrows anteriorly with more (male) or less (female) produced posterior angles, a few small spinules on almost unraised anterior margin; bulges and smooth on disk, with stray minute spinules; upright basal margin with two emarginations and large spinules forming two bands that diverge laterally and are medially separated by longitudinal groove. Pronotal base thus appears impressed antero-laterally in middle. Mesonotum bulges slightly, with a few fine spinules forming two tufts. Metanotum behind middle with pair of insignificant round prominences covered with short acute spinules.

Abdomen elongate, gradually narrows posteriorly. Abdominal tergites bulge, with median longitudinal groove and numerous fine paramedial spinules (up to 25) in posterior half forming extensive tuft (male), or very large spinules (five to eight each) on protuberant coriaceous base usually forming transverse row (female); anterior half with fine dispersed spinules (male) or glabrous, without spinules (female). Tip of abdomen (dorsal view) with pair of small urogomphi (male) or without them, more or less rounded, only with two tubercular projections (female), and bound laterally with sharp spinules. Valvifers of female large, narrow toward base, broadly rounded apically and with projecting tubercle here. Length of body 16 to 18 mm, width of abdomen 5.0 mm.

Material: From Altai, Khakasia, Tuva, Baikal region, Trans-Baikal, and Ussuri-Primor'e region. Adult insects 668, including 40 raised in the laboratory, larvae 37, pupae—one male and three females.

Distribution: Siberia from Altai, Ob' to Pacific Ocean coast; northern Mongolia, northern China, Korea, and Japan.

375 *Biology:* Inhabits mainly mountain forest belt. Ecologically associated with deciduous wood species. Found in mountains up to a height of 1,000 m. Flight of beetles commences end of May and ceases in first half of August. Beetles maximum in last 10 days of June and first 10 days of July. Of the 268 beetles collected in Altai, four (1.5%) were found in May, 97 (36.1%)—June, 166 (62%)—July, and one (0.4%)—August.

Beetles quite often seen gathering pollen from flowers of Umbelliferae, Rosaceae, and other plants. Female lays eggs in bark crevices. Colonizes mainly trunks and secondary shoots of standing and fallen dead trees. One female can lay up to 64 eggs in her lifetime. Larvae hatch from eggs three weeks after oviposition. In 1968 in Salair forests they appeared 18 to 23 days after oviposition, average 20 ± 0.1 days (60 eggs kept under observation). Atmospheric temperature during egg

development dropped to -10°C at night and rose during the day to 28 to 30°C , average about 18.5°C .

Larvae live initially under bark, later bore deeper into wood, make longitudinal galleries upward, and plug them with fine frass. Gallery terminates in pupal cell. Length of cell 22 to 23 mm, width 4.0 to 5.0 mm. Sometimes hollow gallery (not filled with frass) extends upward from cell. Pupation of larvae commences after second hibernation and continues from early May to mid-June. Pupae found up to end of this month, but maximum in early June. Young beetles appear in last 10 days of May, but en masse emergence of beetles occurs in last 10 days of June. Before emergence from wood beetles nibble round openings 3.0 to 4.5 mm in diameter on trunk surface. Emergence of beetles from wood commences in last few days of May and ceases in first half of July. Life cycle completed in two years. Weight of larvae 98 to 195 mg, pupae 75 to 153 mg, beetles 57 to 102 mg. Sometimes midgets weighing under 50 mg develop, especially in dry wood (with the onset of dry weather).

L. duodecimguttata (F.) colonizes deciduous wood species. I raised larvae collected from birch, willow, bird-cherry, oak, alder, and aspen. Inhabits thick- and thin-trunked trees including undergrowth with a trunk diameter of 4.0 to 2.0 cm. Not found on viable trees.

12. *Leptura ochraceofasciata* (Motsch.)

Motschulsky, 1861, *Études Entomol*, vol. 10, p. 21 (*Stenura*); Gressitt, 1951, *Longicorn Beetles of China*, vol. 2, p. 101; Kojima and Hayaishi, 1969, *Insect Life in Japan*, vol. 1, p. 31.

Adult (Figure 242): Similar to *Leptura quadrifasciata* L. in color of elytra and to *L. arcuata* Panz. in curvature of hind tibiae. Differs from both in dense golden hair cover. Head with close fine punctation concealed under dense adherent hair cover, sharp flange posteriorly, and longitudinal suture in middle of frons. Temples densely pubescent, upright almost at level of posterior margin of eyes. Eyes bulge markedly, finely faceted, with narrow deep emargination. Antennae thin and extend beyond 0.66 (female) or 0.75 (male) length of elytra, slightly shorter than body. Third antennal segment equal to 5th, notably longer than 1st.

Pronotum markedly narrows anteriorly, with deep flange anteriorly, curved anterior margin, small transverse groove at base, posterior angles produced laterally, bulges on disk, sometimes with faint median longitudinal groove, with fine close punctation and dense adherent hairs. Scutellum flat and pointed apically, with dense light-colored hairs.

376 Elytra markedly narrow from humeri to apex, obliquely notched apically, with markedly produced outer angle; with fine close puncta-

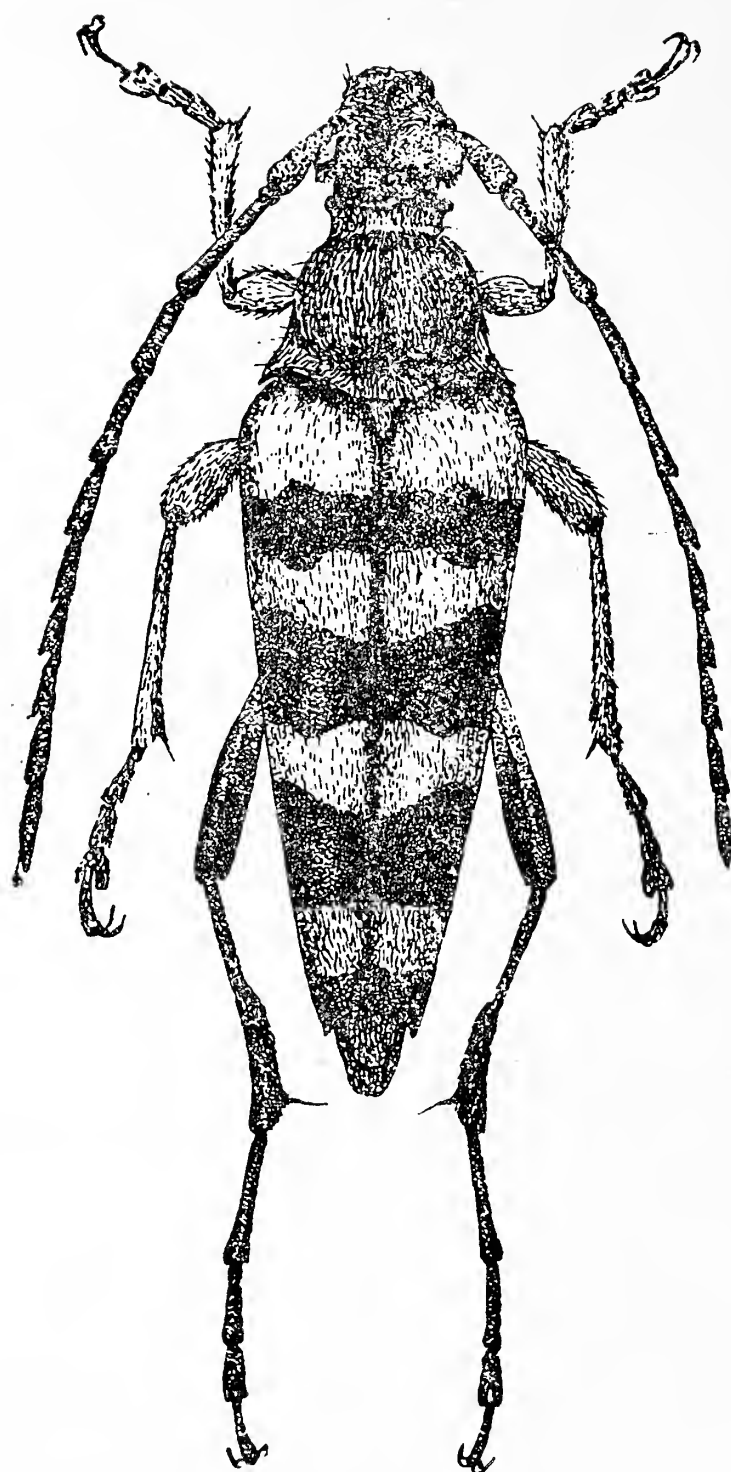


Figure 242. *Leptura ochraceofasciata* (Motsch.).

tion and short semiadherent hairs; sometimes humeral tubercles project like carinae. Hind tibiae curved, with distinct projection on inner side behind middle (male) or straight, without noticeable projection on inner side (female). First segment of hind tarsi considerably (female) or slightly (male) longer than two successive segments together. Body ventrally with dense closely adherent hairs. Body black. Elytra golden-yellow, with black transverse bands: one in anterior half, second medial, third behind middle, and fourth at apex. Legs rusty; apices of hind femora, tibiae, and tarsi dark brown. Antennae dark brown, 1st segment rusty. Length of body 17 to 22 mm.

Egg: White, elongate, narrowly rounded at ends as though pointed, gradually narrows angularly toward one pole, more sharply toward the other and here slightly produced at end. Chorion with large deep cellular sculpture. Cells five- or six-faceted; spaces between them comparatively narrow. Length 2.0 mm, width 0.6 mm.

Larva (Figure 243): Similar to that of *Leptura arcuata* Panz. Differs in structure of pronotal shield, absence of sclerotized strip before locomotory ampulla on abdominal tergite VII, and other features. Head gently narrows anteriorly and more steeply posteriorly, rounded laterally, with long hairs on anterior margin. Epistoma flat, not impressed, with prominent trilobate brownish spot at apex in mature larvae with lobes extending along sutures [in this feature closer to larva of *Leptura regalis* (Bat.)]. Hypostoma bulges slightly, insignificantly narrows anteriorly, with narrow white gula in middle, and 10 to 12 setae along sides of gula in anterior half forming two indistinct transverse rows. Clypeus white, with narrow brownish band at base. Labrum bulges, glabrous on disk, with short setae on margins, and eight to ten erect setae at base forming transverse row. Mandibles obliquely notched apically, with projecting (lower and upper) denticles, and matte impressed medial transverse groove on outer side of anterior half.

Pronotum with parallel sides or insignificantly broadens anteriorly, 377 with long setaceous hairs laterally and short ones on disk, yellowish-rust transverse band in anterior half extending laterally and forming here a broad yellowish-rust lustrous area. Pronotal shield bulges, striate, with almost straightly truncate anterior margin, slightly produced antero-

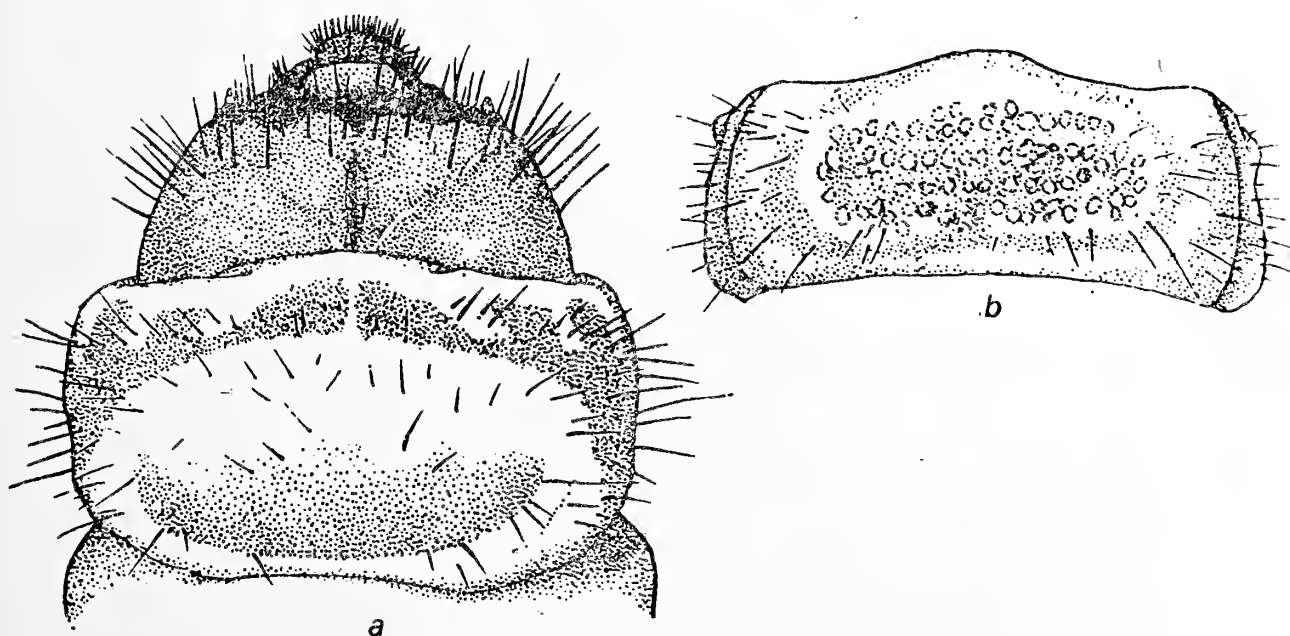


Figure 243. Larva of *Leptura ochraceofasciata* (Motsch.).

a—head and pronotum; b—abdominal tergite with locomotory ampulla.

medially, broadly rounded basally, rarely (especially on anterior margin) with stray setae. Meso- and metanota sclerotized in anterior half, with distinct minute spinules. Eusternum sclerotized, with minute brownish spinules, coriaceous anteriorly and posteriorly (in form of transverse band) with numerous setae in anterior half.

Abdomen laterally and tergites behind locomotory ampullae with short setaceous hairs. Dorsal locomotory ampullae on tergites I to VI bulge, transversely elongate, with granules forming four transverse rows of two ellipses. Inner rows markedly proximate. Granules of posterior rows quite often project more, anterior ones smoothened. Locomotory ampulla on tergite VII faintly developed, with two rows of minute granules. Spinous sclerotized band lacking in front of this ampulla. Ventral locomotory ampullae on abdominal sternites I to VII with two rows of granules each. Length of body 34 mm, width of head 4.0 mm.

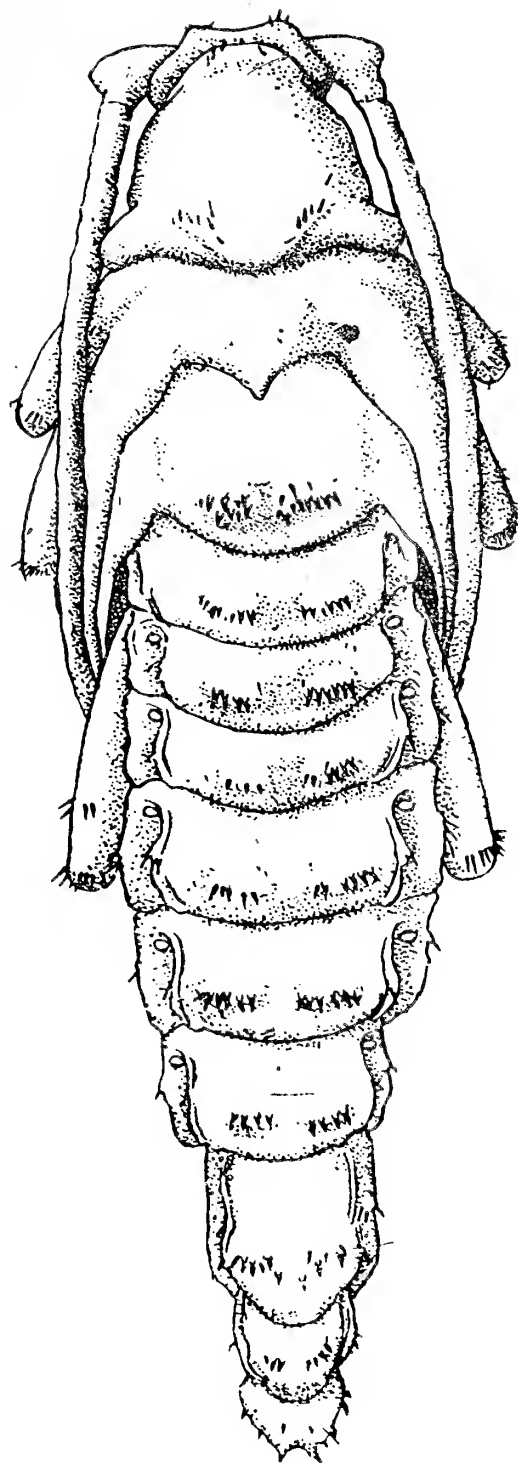
Pupa (Figure 244): Differs from pupae of other species in absence of tufts of spines on pronotal disk. Head almost flat between antennae, with four spinules at antennal base on inner side in longitudinal row, three to five spinules on occipital protuberances behind eyes, and three
378 pairs of fine spinules on anterior margin of frons, of which middle pair shifted slightly upward. Antennae arcuate, closely flexed to sides.

Pronotum elongate, narrows anteriorly, with projecting posterior angles, without noticeable flange anteriorly, bulges and smooth on disk, without spinules or only with stray ones, with faint longitudinal groove; impressed medially on posterior margin, steeply raised lateral to this impression, and here with acute subulate spinules forming transverse band (female) or transverse flexed row (male). Mesonotum bulges, lustrous, with pair of widely separated spinules. Metanotum smooth, with slight paramedial prominence in posterior half bearing 10 to 12 (male) or 22 to 24 (female) short acute spinules.

Abdomen elongate, narrows posteriorly from segment V. Abdominal tergites with sharp spinules on protuberant coriaceous base in posterior half along sides of longitudinal groove forming transverse row (of five to ten spinules in each row). Tip of abdomen (dorsal view) narrowly rounded, at end with pair of short urogomphi (in female barely distinct) that terminate in small sharp spinule bent laterally; obtuse ventrally, bound laterally by horseshoe-shaped carina set with short thick spinules. Abdominal sternites with minute indistinct piliform lateral setae forming transverse band. Valvifers of female small, hemispherical. Length of body 23 mm, width of abdomen 5.0 mm.

Material: Collected in Sakhalin and Kunashir. Adult insects 116, larvae 18, pupae—two males and three females.

Distribution: Primarily an insular species. Found in islands of Sakhalin and Kunashir; in Japan—Hokkaido, Honshu, Shikoku, and Kyushu.



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Figure 244. Pupa of *Leptura ochraceofasciata* (Motsch.), male.

According to Gressit (1951), found in Korea and northern China. I did not find it in Ussuri-Primor'e region.

Biology: In Kunashir, *Leptura ochraceofasciata* (Motsch.) is found in deciduous and mixed vegetation. Ecologically associated with deciduous wood species. Flight of beetles occurs in July and August. Beetles often sighted on flowers of various plants including hydrangea (*Hydrangea paniculata*), some Umbelliferae, and others. None are seen from end of August to early September. Female lays eggs on trunks of dead trees in basal zone of birch (*Betula maximovicziana*), alder (*Alnus iaponica*, *A. maximoviczii*), maple, oak, and other wood species.

Larvae live in upper layer of wood, make straight or quite often meandering galleries along trunk, and plug them with fine frass. At end of May or in June, roughly after third hibernation, larvae make cell along trunk, leaving layer of wood 5.0 to 20.0 mm between cell and bark. Length of cell 24 to 25 mm, width 6.0 to 14.0 mm. Width of larval gallery before cell 9.0 to 13.0 mm; inlet to cell plugged with coarse fibrous frass constituting "stopper" 18 mm long.

Pupation of larvae commences early June and ends in July. Pupae maximum in first half of July. Young beetles seen in cells at end of June-early July, and stray insects emerge in first half of August. I collected one beetle from wood on August 5th and another emerged on August 18. Beetles nibble an exit through which they abandon pupal cell. Length of exit 6.0 to 20.0 mm and diameter 6.0 to 8.0 mm. Beetles emerge from wood with developed gonads and are capable of reproducing without supplementary feeding. Dissection of one female extracted from wood revealed 32 mature eggs in the ovaries. Another female, 379 picked from flowers had 40 eggs in her ovaries, and another 60. Data from a few weighings revealed weight of larvae 142 to 374 mg, pupae 220 to 340 mg, and beetles 149 to 272 mg. This species colonizes trunks up to 30 cm or more in diameter. *Distenia gracilis* (Bless.) is found together with this species.

13. *Leptura latipennis* Matsusch.

Matsuschita, 1933, *Ins. Matsum.*, vol. 7, p. 3; Kojima and Hayashi, 1969, *Insect Life in Japan*, vol. 1, p. 32.

Adult (Figure 245): Readily recognized by yellowish-brown elytra. Body elongate. Head with narrow median longitudinal suture, fine punctation, dense golden hairs, combed in region of frons toward base of antennae and between posterior lobes of eyes toward middle. Temples short, with dense erect hairs. Eyes finely faceted, with broad notch. Antennal apices barely reach beyond middle of elytra (male) or even do not reach this level (female). Fifth antennal segment longer than 4th, equal to 1st; 3rd segment longest, slightly shorter than 4th and 5th segments together.

Pronotum markedly, almost spherically bulges, with close fine punctation, deep flange anteriorly, transverse broad groove basally; with golden closely adherent hairs, thin stray erect hairs laterally, usually with smooth median longitudinal band, and with acutely produced posterior angles. Scutellum elongate, pointed posteriorly, 2.0 times longer than width at base, with light-colored adherent hairs.

Elytra elongate, in female almost parallel, in male narrow behind humeri, bulge moderately, taper on inner side at apex; with projecting outer and rounded inner angles, fine close punctation, and short semiad-

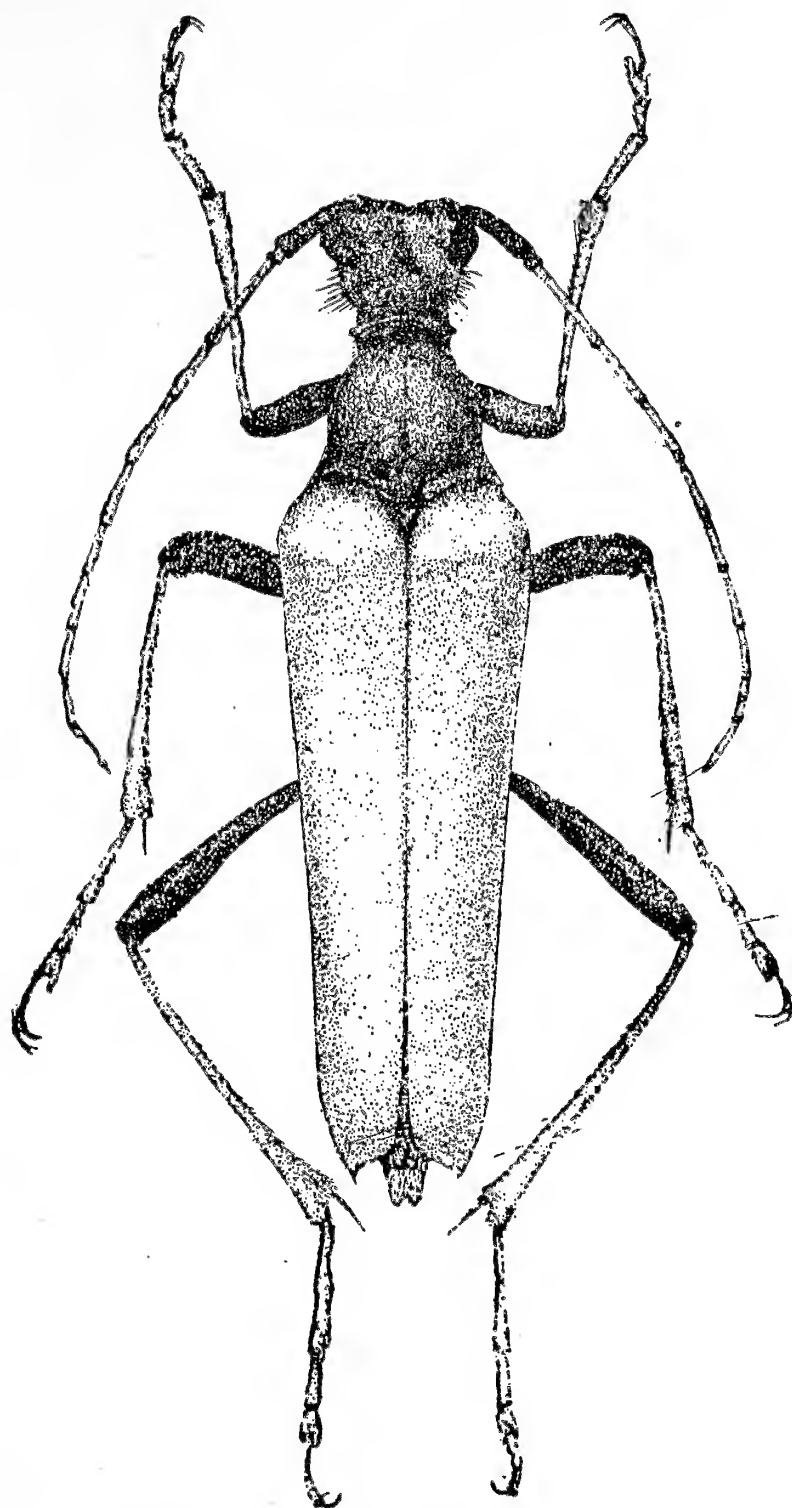


Figure 245. *Leptura latipennis* Matsusch.

herent yellowish hairs. Hind femora long and even (female) or thin at base, notably thicken toward apex (male). Hind tibiae in male slightly curved, in female straight. First segment of hind tarsi longer than all successive segments together. Body, all femora, and scutellum black.
 380 Antennae, tibiae and tarsi light rust. Elytra yellowish-cinnamon, sometimes darken on suture from base, alongside scutellum with whitish, much lighter-colored spot. Length of body 16 to 21 mm.

Egg: White, very similar to that of *Leptura ochraceofasciata* (Motsch.), narrowly rounded at poles, narrows steeply toward one end, gently

toward the other. Chorion with sharp cellular sculpture, septa between cells narrow. Length 2.0 mm, width 0.6 mm.

Larva (Figure 246): Differs in complete sclerotization of eusternum, structure of locomotory ampullae, and other features. Head slightly narrows anteriorly, with long lateral hairs in anterior third. Epistoma slightly impressed in posterior half, with prominent trilobate brownish spot at apex in which lobes elongate along sutures; long setae in middle third, frontal sutures straight; longitudinal suture dark brown, light colored only behind black margin as though obliterated. Hypostoma with rounded anterior angles, numerous hairs in anterior half forming three indistinct transverse rows, narrow white longitudinal band medially. Clypeus white, faintly striate on anterior margin along angles. Labrum glabrous on disk, for most part rusty, with two to four setae at base encircled basally by sclerotized ringlet and forming transverse row. Mandibles elongate, gently emarginate apically, matte on outer side, with transverse impression.

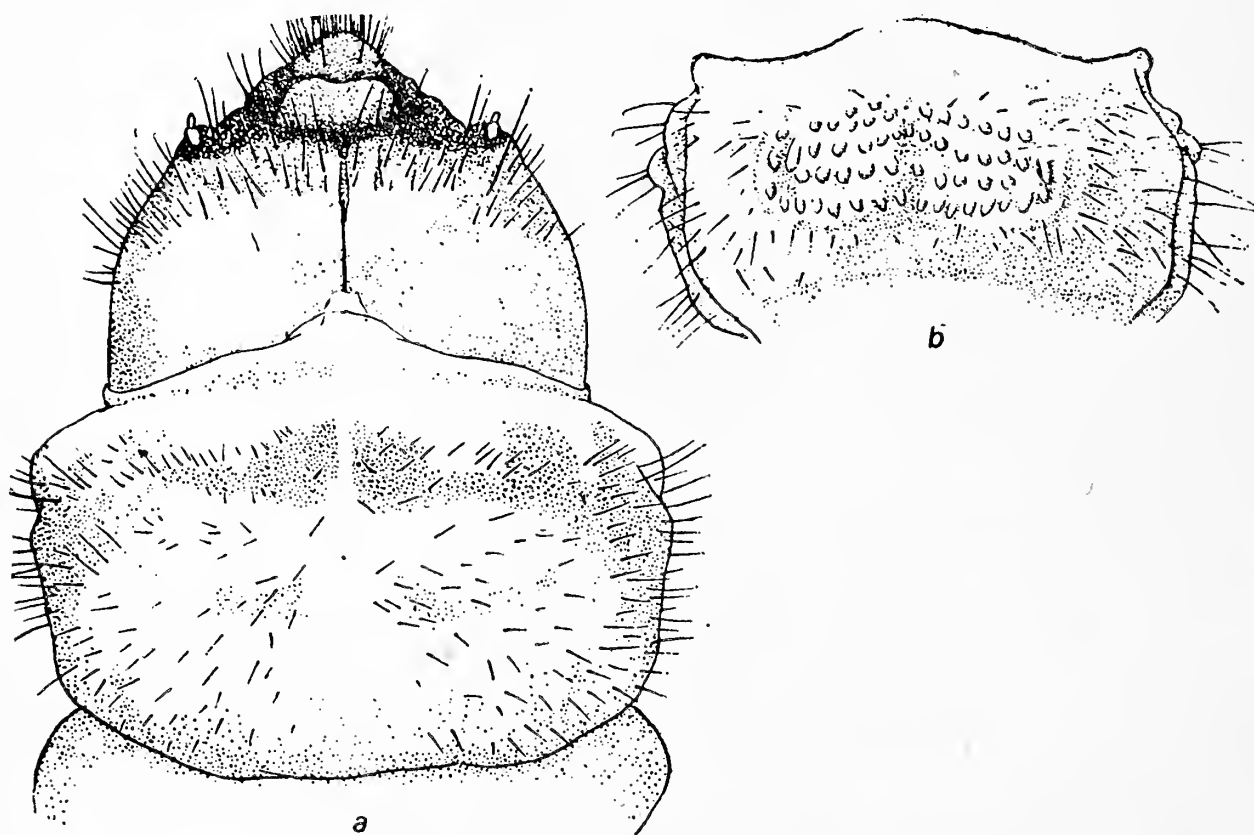


Figure 246. Larva of *Leptura latipennis* Matsusch.

a—head and pronotum; b—abdominal tergite with locomotory ampulla.

381 Pronotum in anterior half with transverse yellow band with three anterolateral deep notches; with short hairs on disk, and long ones laterally forming two lateral transverse bands. Pronotal shield bulges, striate, without notable medial emargination in anterior margin. Eusternum entirely sclerotized, with fine dense spinules; at anterior margin with

four setae, elsewhere only stray ones, forming in some specimens transverse row basally. Thoracic legs short, claws light colored basally, dark apically, short, acute.

Abdomen laterally with short sparse hairs. Dorsal locomotory ampullae divided by narrow median longitudinal groove, slightly elongate transversely, oval, with granules forming two transversely elongate ellipses anteriorly and posteriorly; also sclerotized between inner rows of granules, with minute brownish spinules. Locomotory ampulla on tergite VII with fine granules, girdled by brownish sclerotized band consisting of minute brownish spinules. Ventral locomotory ampullae developed on abdominal sternites I to VII, consist of two rows of granules shifted laterally and joined medially (in form of figure eight); broad transversely sclerotized brownish band anteriorly and narrow one posteriorly. Body length of mature larva 28 mm, width of head 4.5 mm.

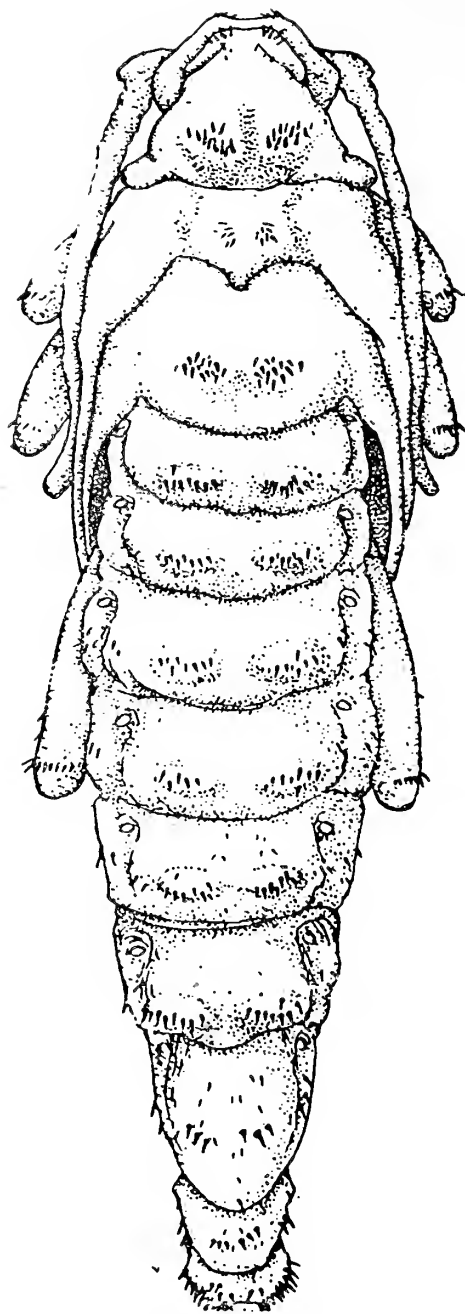
Pupa (Figure 247): Characterized by elongate abdomen, slender at apex. Head between antennae slightly bulges transversely, between posterior lobes of eyes flatly impressed, with laterally projecting occipital protuberances bearing five to six short spinules, three spinules along each side on anterior margin of frons forming transverse row, and four to six spinules laterally on inner side of antennae. Antennae flexed to sides, arcuate in distal half.

Pronotum narrows anteriorly, with transverse flange anteriorly, stray spinules on anterior margin, glabrous in posterior half of disk, without spinules, with produced posterior angles, and short deep longitudinal groove in middle of base; steeply raised posterior margin appears paramedially impressed anteriorly and set with group of sharp subulate spinules forming slightly flexed transverse band. Mesonotum bulges, with four to seven acicular spinules forming tuft on each side. Metanotum with longitudinal groove, in posterior half along sides with small tubercular prominence covered with short acute spinules.

Abdomen with parallel sides, narrows posteriorly from segment V, elongated in region of segments VII to VIII, rounded apically (dorsal view), obtuse ventrally, bound by horseshoe-shaped carina set with short acute spinules. Urogomphi lacking. Abdominal tergites bulge in posterior half and with seven to eight sharp subulate spinules here along sides of longitudinal groove forming regular or indistinct row, with sparse minute, barely perceptible acicular spinules in middle and in anterior half, which sometimes form additional transverse rows. Valvifers of female hemispherical, slightly produced laterally at apex. Length of body 20 to 21 mm, width of abdomen 6.0 mm.

Material: Collected on Kunashir Island. Adult insects eight, larvae 16, and pupae—three females.

Distribution: Sakhalin and Kunashir; Japan (Hokkaido and Honshu). Belongs to group of island relicts.



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Figure 247. Pupa of *Leptura latipennis* Matsusch., female.

Biology: Ecologically associated with alder. Beetles seen on flowers in July, found up to September inclusive. Ovaries of two females picked from flowers contained 92 and 39 eggs respectively. Female lays eggs on bark of dead trees. Larvae live in wood, quite often damaged by rot. They make galleries not only in upper layers, but also deeper layers along trunk, and plug them with fine frass. Galleries in thin shoots sometimes made along pith. Width of gallery made by mature larvae 8.0 to 10.0 mm. Larva makes cell along trunk at end of gallery in upper layer of wood. Gallery around cell plugged with very coarse fibrous frass. Length of cell 23 to 30 mm, width 8.0 mm. Sometimes exit made to trunk surface at end of cell. If so, layer of wood up to 17 mm thick remains between cell and bark at this site. Larva pupates with head upward.

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Pupation occurs in June and early July. Pupae found up to August. Emergence of young beetles commences in first few days of July and ceases end of this month or in first half of August. Weight of prepupae 185 to 386 mg, pupae 168 to 351 mg, and beetles 140 to 271 mg. Colonizes trunks not only in lower but also upper zone at a height of up to 8.0 m, and also branches up to 10 cm thick.

14. *Leptura femoralis* (Motsch.)

Motschulskyi, 1860, *Études Entomol.*, vol. 9, p. 40 (*Stenura*) *xanthoma*, Bates, 1873, *Ann. Mag.*, vol. 12, p. 195; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 456-457 (*Strangalia*); Gressit, 1951, *Longicorn Beetles of China*, vol. 2, p. 103; Kojima and Hayashi, 1969, *Insect Life in Japan*, vol. 1, p. 33 (*Pedostrangalia*).

Adult (Figure 248): Characterized by elytra narrowing at apex along inner side and their sharply produced outer angles. Body dorsally slightly convex, humped. Head short, with punctation, dense light-colored long hairs, and upright sharp flange at back; frontal tubercles project markedly; anterior margin of frons with smooth triangular glabrous area; clypeus with very large sparse punctation and long erect hairs. Antennae thin, reach apex of elytra (male) or just short of this level (female); 3rd segment longest, almost equal to 6th and 7th segments together.

Pronotum narrows anteriorly, compressed laterally in posterior half, flange lacking anteriorly, only narrow curved border on anterior margin, broad transverse groove at base, posterior angles produced posterolaterally, bulges on disk, with very fine smoothened punctation and minute adherent hairs.

Elytra elongate, bulge, more (male) or less (female) narrow toward apex, taper roundly at apex on inner side, with sharply produced outer angles; with fine close punctation and light-colored semiadherent hairs. First segment of hind tarsi longer than remaining ones together, 3rd segment narrow, bifurcate over more than half length (to two-thirds). Body black. Forefemora almost entirely (except for apex), and mid- and hind femora basally yellowish-rust. Humeral tubercles on elytra rarely with yellow spot (ab. *xanthoma* Bat.). Length of body 12 to 15 mm.

Egg: White and elongate, broadly rounded at poles. Chorion with indistinct sculpture, acquiring cellular structure at poles. Length 1.7 mm, width 0.5 mm.

Larva (Figure 249): Characterized by three ocelli on sides of head at base of antennae, and locomotory ampullae well developed on abdominal segments I to VI. Head broadens angularly in posterior half, markedly narrows anteriorly, with long dense hairs in anterior half, three pigmented ocelli laterally near antennae forming narrow transverse

band. Epistoma in some specimens markedly, in others barely impressed in posterior half, with sparse setaceous hairs forming two transverse rows. Frontal sutures narrow and straight. Longitudinal suture of epistoma brownish-cinnamon, sharply distinct behind, and obliterated or altogether invisible at anterior margin. Hypostoma bulges, distinctly narrows anteriorly, with almost straight or slightly convex sutures laterally, narrow gula medially, and seven to eight setaceous hairs along sides of gula in anterior half. Clypeus lustrous white, at base rusty-brown, bulges, and only 0.50 width on anterior margin. Labrum

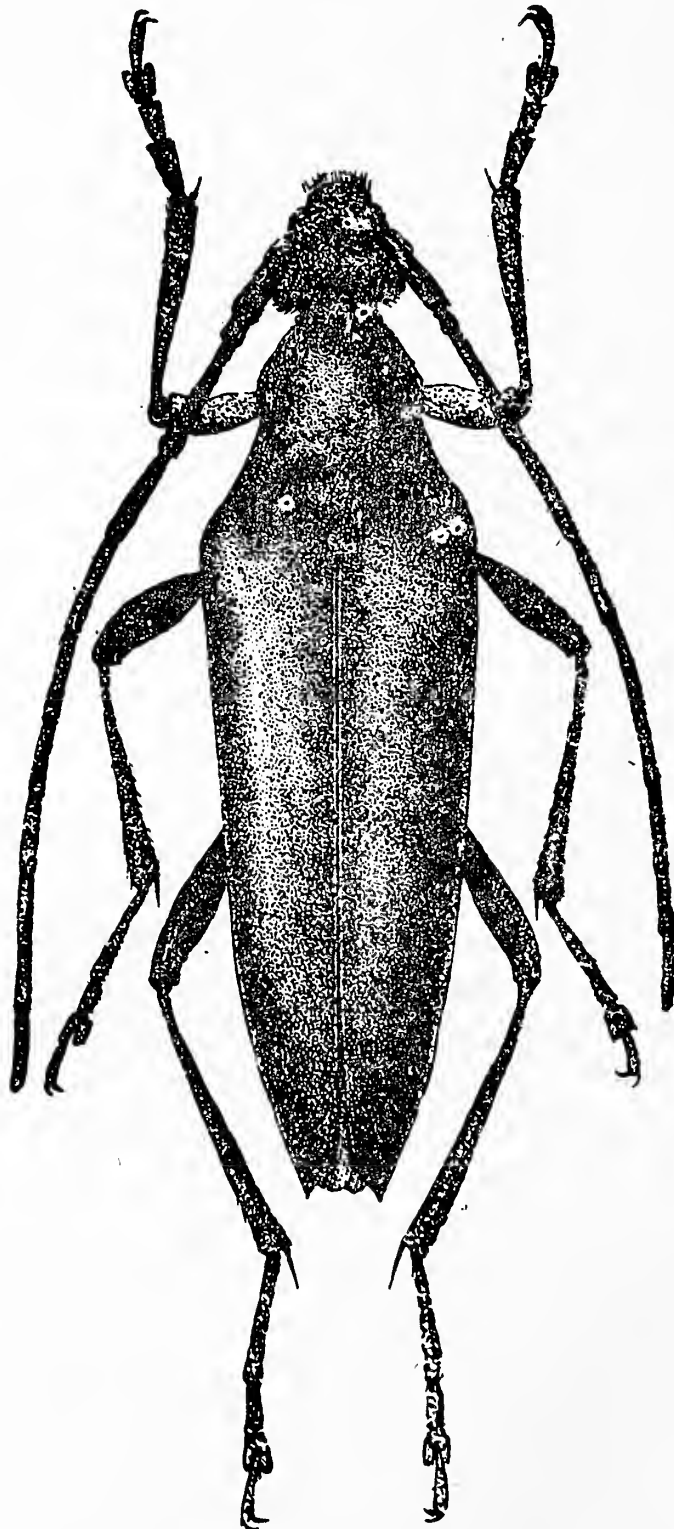


Figure 248. *Leptura femoralis* (Motsch.).

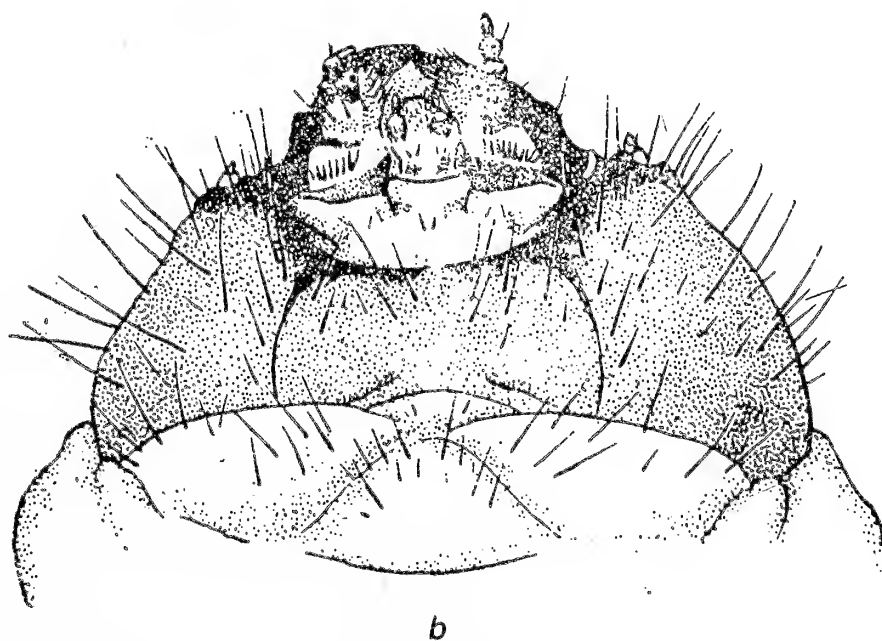
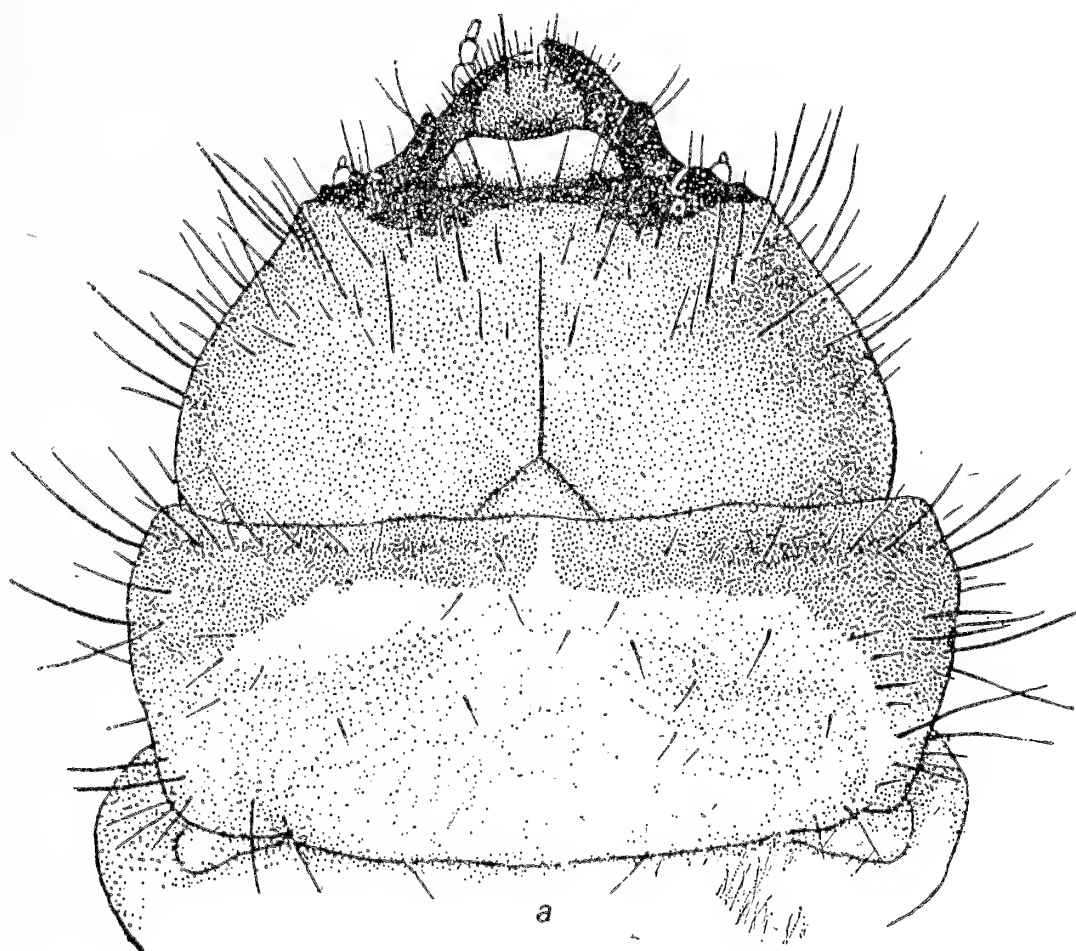


Figure 249. Larva of *Leptura femoralis* (Motsch.).
a—head and pronotum; b—head (ventral view).

brownish-red, elongate or almost transverse, narrowly or gently rounded on anterior margin, with sparse long setae, which in posterior half form transverse row. Mandibles thicken basally, taper markedly on upper margin toward apex, with acute rostriform projecting lower denticle, longitudinally striate on outer side on top along cultrate edge.

Pronotum transverse, with very dense long hairs laterally, short stray ones on disk, broad yellow transverse band in anterior half that broadens like facets on sides and is markedly elongate anteromedially. Pronotal shield white, bulges at base, rolled anteriorly or with distinct projection in middle of anterior margin, lustrous, with indistinct striation. Prosternum with long sparse hairs. Eusternum bulges, lustrous, without striation, coriaceous, with long setaceous hairs in anterior half. Thoracic legs well developed, claws long and acicular.

Abdomen laterally with long thin, not very dense, light-colored hairs. Dorsal locomotory ampullae developed on abdominal tergites I to VI, divided by two transverse grooves separating inner slightly granulate carina, and two rows (anterior and posterior) of faintly outlined granules. Short setae on inner carina demarcate fused inner rows of granules. Tergite VII smooth or sometimes with transversely grooved band. Ventral locomotory ampullae developed on abdominal sternites I to VI, divided by transverse groove, with two parallel rows of large granules. Tergite IX broad basally, broadly rounded apically, with projecting margins; four long hairs behind middle form transverse row. Body length of mature larvae 18 mm, width of head 4.5 mm.

Pupa (Figure 250): Clearly distinguished by body form and structure of tip of abdomen. Body cylindrical. Head short, flat, not impressed
384 between upper lobes of eyes; with long thick lateral setae on occipital protuberances forming longitudinal dense row (five to seven setae in each row), long setae around base of antennae on inner side forming two tufts, and very thin setae on anterior margin of frons forming transverse row. Antennae almost curved annularly.

Pronotum narrows anteriorly, bulges moderately on disk, smooth on anterior margin, without setae, with insignificantly produced lateral margins and here with stray large setae; long acicular setae at base set densely on protuberant coriaceous base form two transverse bands separated by broad interception (equal to length of seta). Mesonotum
385 without setae, bulges, transversely striate, glabrous. Metanotum broad, also transversely striate. with thin paramedial basal setae set on protuberant coriaceous base forming two small dense tufts narrowly separated.

Abdomen with parallel sides, almost cylindrical. Abdominal tergites bulge, with thin long setae in posterior half along sides of longitudinal groove set on protuberant coriaceous base, directed backward, and forming dense tuft. In each tuft inner setae next to longitudinal groove

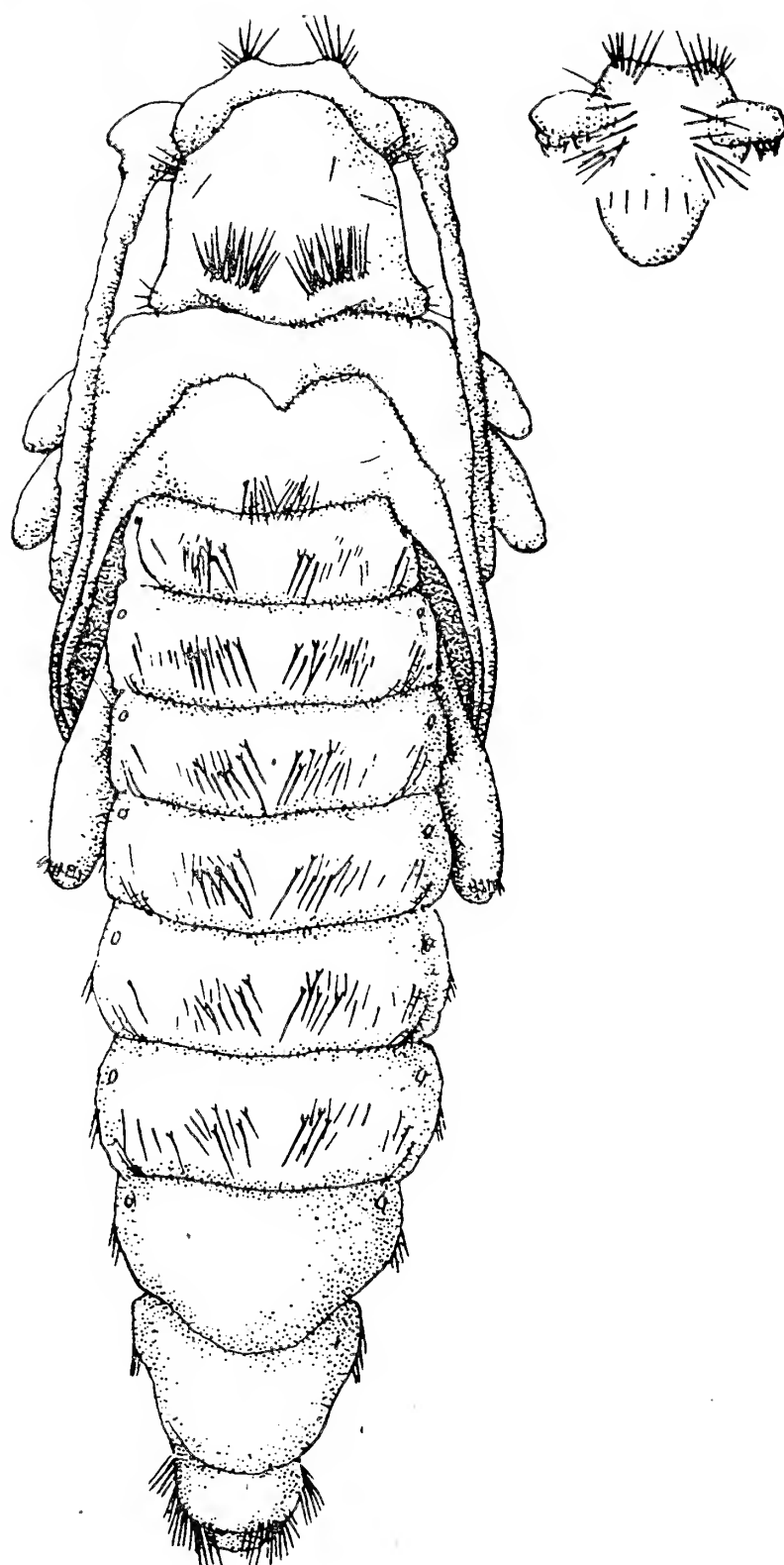


Figure 250. Pupa of *Leptura femoralis* (Motsch.).

very large; outer lateral ones much smaller. Tip of abdomen obtuse and bound by horseshoe-shaped carina covered with dense thin long piliform setae. Valvifers of female hemispherical, small. Length of body 12 mm or more, width of abdomen 3.5 mm.

Material: Collected in Ussuri-Primor'e region, Sakhalin, and Kunashir. Adult insects 25, larvae seven, pupa—one male, and exuviae of larvae and pupae (female) one each.

Distribution: Amur basin from Shilka and Argun' Rivers to Pacific Ocean coast, Ussuri-Primor'e region, Sakhalin, Kunashir; Japan (Hokkaido, Honshu, and Kyushu), Korea, and northeast China.

Biology: Lives in broad-leaved forests. Ecologically associated with Manchurian striped maple (*Acer tegmentosum*), Ussuri pear (*Pyrus ussuriensis*), and other wood species. Flight of beetles commences in middle 10 days of June and ends in August. Beetles sighted on flowers of different plants. Female lays eggs in bark crevices of standing dead trunks and dead branches of viable trees. On dissection the ovaries of one female (two weeks after emerging from wood) contained 32 fully formed eggs, while those of a female picked from flowers on August 11 contained 46 eggs. Larvae live in dead, sometimes even decomposed wood. They make galleries along trunk and plug them with fine frass. Length of gallery 10 cm, width 8.0 mm.

Larvae pupate in May and early June after second hibernation; beetles appear in first half of June and remain in cells for about one 386 week. I found larvae and a beetle in decomposed wood of thick dead branches on a viable Manchurian striped maple. They were at the base of the branches and had penetrated deep inside the trunk. One larva was found in each inhabited branch.

12. Genus *Strangalia* Serv.

Serville, 1835, *Ann. Soc. Entom. France*, vol. 4, p. 220; *Strangalia*, Aurivillius, 1912, *Col. Cat.*, vol. 39, p. 340; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 457 (*Strangalia*); Linsley and Chemsak, 1976, *Ceramby. North Amer.*, 80, pp. 7-8.

Adult: Distinguished by pronotum with posterior angles markedly produced laterally, narrow elongate elytra markedly narrowing toward apex, and distinct 4th segment of hind tarsi.

Egg: Smooth, elongate, without cellular sculpture.

Larva: Characterized by white transverse band on epistoma, sclerotization of eusternum at base, and developed locomotory ampullae on abdominal segments I to VII.

Pupa: Distinguished by long acicular setae forming two dense tufts each on metanotum and abdominal tergites along sides of longitudinal groove, widely separated urogomphi at tip of abdomen, and conical terminal projection on valvifers of female. This genus covers extensive expanses of Europe, Asia, and North America. One species distributed in northern Asia.

Type species: *Leptura attenuata* Linnaeus, 1758.

1. *Strangalia attenuata* (L.)

Linnaeus, 1758, *Syst. Nat.*, 10th ed., p. 398 (*Leptura*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 458-440 [*sic*] (*Strangalina*); Gressit, 1951, *Longicorn Beetles of China*, vol. 2, p. 114; Kojima and Hayashi, 1969, *Insect Life in Japan*, vol. 1, p. 35.

Adult (Figure 251): Body elongate, thin. Head with close punctation and median longitudinal suture; apex of smooth triangular facet at

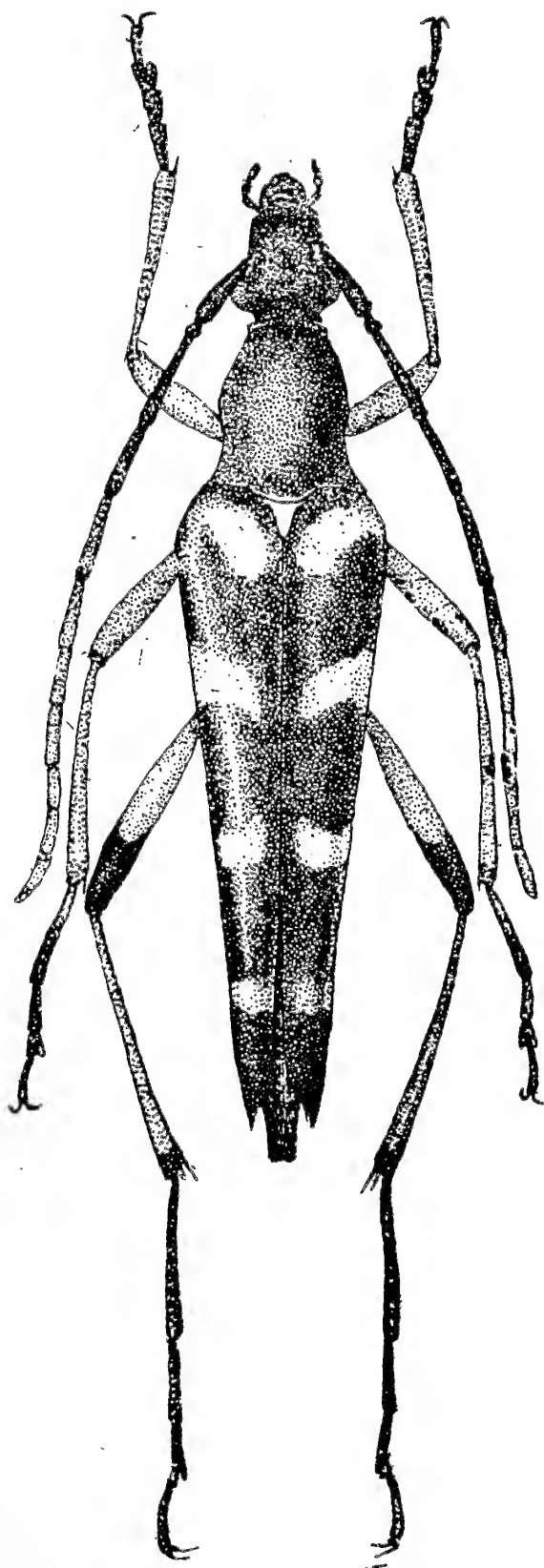


Figure 251. *Strangalia attenuata* (L.).

clypeus turned upward, sides of this facet sometimes carinate. Clypeus with sparse large punctation, genae broad and long, temples short and rounded. Eyes bulge markedly, insignificantly emarginate on inner side. Antennae extend beyond 0.50 or 0.66 length of elytra; 1st segment thick, with large deep punctation, equal in length to 5th.

Pronotum elongate, with almost parallel sides in posterior half, narrows anteriorly, with narrow flange on anterior margin, narrowly bent anterior margin, small transverse impression at base, posterior angles turned laterally, and uniformly bulges on disk; with dense punctation and short light rust hairs. Scutellum resembles triangle or slightly elongate, pointed apically, with dense punctation and brownish hairs.

Elytra elongate, markedly narrow from base to apex, with uniform fine punctation, semiadherent light rust or brownish hairs, more or less distinct longitudinal dent between humeri and scutellum, obliquely notched apically, with markedly elongate outer angles. Legs long and slender; hind tarsi markedly longer than tibiae, 4th segment of hind tarsi distinct, stands out somewhat due to notched apex of 3rd segment.

Abdominal sternite V in male insignificantly notched at posterior margin, with long longitudinal trough-shaped groove in middle (groove short in female), more or less distinct only at posterior margin. Body black. Flange on head with light reddish apically bifid spot. Elytra reddish-rust, with black bands before middle, in middle, at beginning of middle third, and at apex. Legs rusty; apex of hind femora and partly hind tibiae black (f. *typica*). Sometimes pronotum with reddish spots on anterior margin (ab. *maculicollis* Gabr.) or red with two black bands on disk (ab. *thuznheri* Heyr.). Length of body 12 to 18 mm.

Egg: White, elongate, gently rounded at poles. Chorion smooth, without cellular sculpture. Length 2.0 mm, width 0.5 mm.

Larva (Figure 252): Characterized by sharp white transverse band on epistoma, distinctly developed locomotory ampullae on abdominal segments I to VII, and sclerotized eusternum. Head slightly rounded laterally, insignificantly but identically narrows anteriorly and posteriorly, with single hyaline ocellus on anterior margin at base of antennae. Epistoma laterally bound by sharp white frontal sutures, transverse white band before middle very prominent against general rusty background, glabrous in posterior half, with long piliform setae in region of transverse white band, with setae at base encircled by sclerotized ringlet. Hypostoma bulges slightly, insignificantly narrows anteriorly, with narrow white longitudinal (gular) band, deep setaceous pores before middle sometimes forming indistinct transverse row, and additional pores in front. Clypeus white, basally brown and lustrous, bulges insignificantly. Labrum transverse, angularly rounded anteriorly, with sparse short setae along margins, glabrous and bulges on disk, with or without pair of

short widely separated setae behind middle closer to base. Mandibles thick basally, obliquely notched apically, with acutely produced lower denticle, and transverse groove on outer side.

Pronotum 2.0 times wider than long, lustrous in anterior half, with transverse rusty-yellow band with deep whitish notch in anterolateral margin, narrow white longitudinal clearance in middle, with stray setaceous hairs. Pronotal shield bulges insignificantly, rounded on anterior margin, without lateral longitudinal fold; white, with fine faint longitudinal striation. Prosternum with very dense short setaceous hairs in region of presternum. Propresternum glabrous. Eusternum sclerotized posterolaterally, with fine spinules forming two large yellowish spots rounded on inner side and separated by narrow interception, with six hairs in nonsclerotized part forming two longitudinal rows that diverge posteriorly.

388 Abdomen laterally with sparse thin hairs. Dorsal locomotory ampullae bulge, with granules forming two transversely elongate ellipses. Granules of inner ellipse highly proximate, so they form transverse carina interrupted medially by longitudinal groove. Ventral locomotory ampullae divided by transverse groove that joins two rows of granules. Abdominal tergite IX broad, rounded, bulges moderately on disk, with

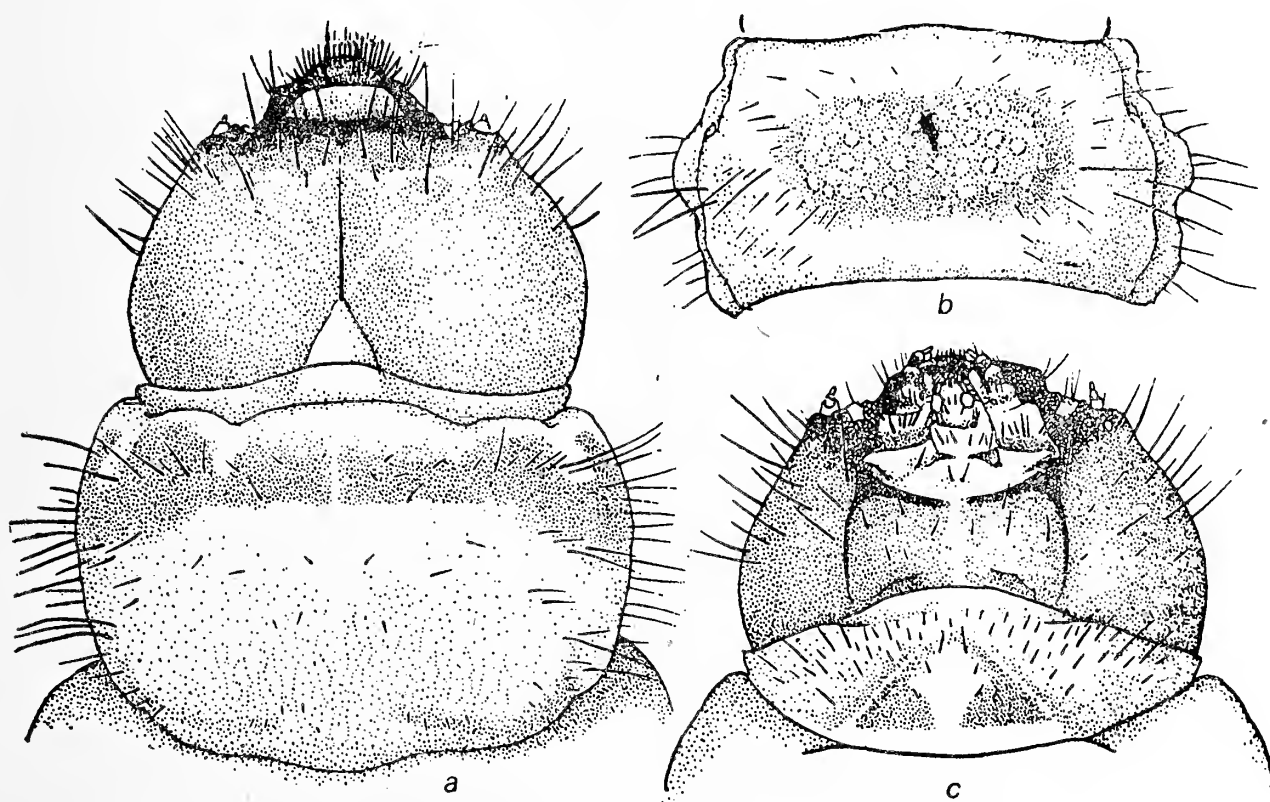
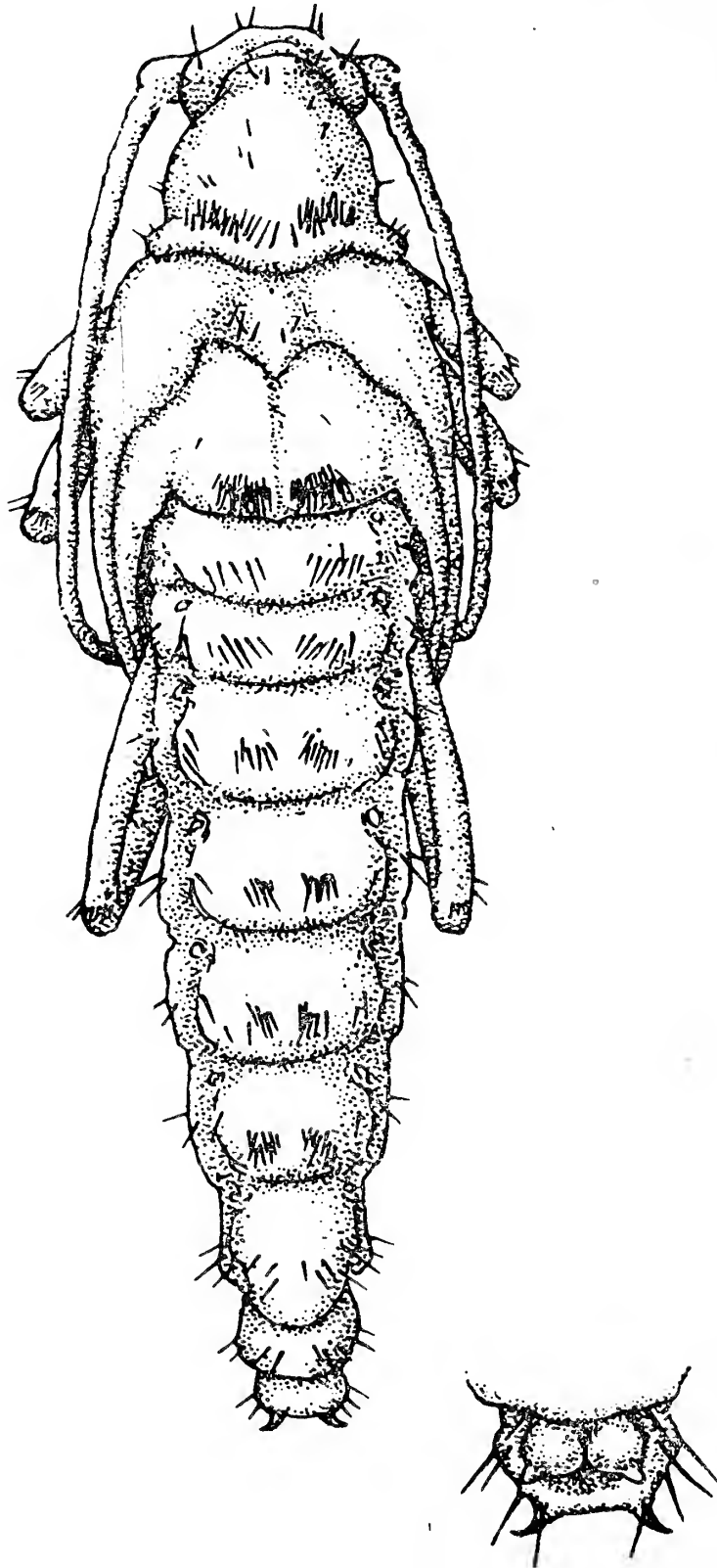


Figure 252. Larva of *Strangalia attenuata* (L.).
a—head and pronotum; b—abdominal tergite with locomotory ampullae; c—head (ventral view).

long sparse hairs forming three transverse rows—one before middle, second more distinct row behind middle, and third at apex. Body length of mature larvae 26 mm, width of head 3.5 mm.

Pupa (Figure 253): Characterized by markedly elongate tip of abdomen, thin acicular setae on dorsal side of body, widely separated urogomphi, and large conical process at tip of valvifers of female. Body slender, elongate. Head between upper lobes of eyes and before base of



antennae with deep transverse groove, one large and two minute setae laterally in region of occipital protuberances, three large setae near antennae in longitudinal row, and six setae on anterior raised margin of frons forming transverse row. Antennae arcuate, with apices pressed ventrad, almost to base of hind femora.

Pronotum glabrous and lustrous on disk, narrows anteriorly, with broad flange on anterior margin, tubercularly raised at anterior margin and here with one to three setae, stray faint setae on anterior clivus, and two insignificant emarginations at base; sharp spinescent setae on posterior margin set on protuberant papilliform coriaceous base form transverse band directed posteromedially and here slightly interrupted. Posterior angles of pronotum significantly produced laterally. Mesonotum with two to three lateral setae. Metanotum bulges, with median longitudinal groove, and long acicular setae on protuberant coriaceous base forming two dense tufts of 13 to 17 setae on each side of groove at base.

Abdomen slightly narrows anteriorly but more posteriorly, markedly elongate in region of segments VII to IX. Abdominal tergites raised in posterior half and here with acicular setae directed backward set on protuberant coriaceous base forming one tuft of six to eight setae on each side of longitudinal groove. Tip of abdomen (dorsal view) with two widely separated urogomphi that terminate in acute spinules and have one lateral setaceous spinule at base. Valvifers of female enlarge toward apex, with large conical, laterally produced process at apex. Length of body 15 mm or more, width of abdomen 3.0 mm.

Material: Collected in forests in Ob' region, Altai, Tuva, Ussuri-Primor'e region, Sakhalin, and Kunashir. Adult insects 260, larvae 32, pupae four, larval and pupal exuviae with beetles from cells six each.

Distribution: Occupies almost all of Eurasia from Atlantic to Pacific Oceans. In northern Asia found in forest and forest-steppe zones and mountain forest belt in the Urals, western Siberian lowland, northern Kazakhstan, Altai, Tuva, basins of Yenisey and Lena Rivers, Trans-Baikal, Kamchatka, Sakhalin, and Kuril' Islands; Japan, North Korea, and northeast China.

Biology: Inhabits mixed and deciduous vegetation. Ecologically associated with deciduous and coniferous wood species. Flight of beetles commences in last few days of June and ends in early September. Beetles maximum in second half of July. Of the 249 beetles collected in different regions over several years 0.4% were found in last days of June, 72.7%—July, 26.5%—August, and 0.4%—early September. Beetles are more active in warm clear weather. They occur on flowers of mountain ash (*Sorbaria*), meadow-sweet (*Spiraea*), rose (*Rosa*), cow-parsnip (*Heracleum*), angelica (*Archangelica*), milfoil (*Achillea*), chamo-

mile (*Matricaria*), and other plants. Beetles feed on flowers, mate, and then fly to dead trees where female lays eggs in bark crevices or in wood fissures. Colonizes stumps and fallen and standing dead trees.

- 390 One female can lay over 100 eggs. Ovaries of one female picked from flowers contained 117 eggs. Larvae hatch two weeks after oviposition. For example, larvae hatched on August 10 from eggs laid on July 24 to 26, and on August 12 from eggs laid on August 1st. They inhabit birch, oak, linden, pine, and other wood species.

On hatching larvae bore into wood and make galleries there along trunk to a depth of up to 1.0 cm, and plug them with fine frass. After second hibernation larva makes cell along trunk, nibbles exit to trunk surface at upper end, leaving a layer of wood up to 1.0 mm thick, and pupates with head toward exit. Length of gallery 30 cm or more, width 9.0 mm. Length of cell 20 to 30 mm, and width 5.0 to 7.0 mm. Sometimes larvae develop on exposed roots and penetrate from there into upper layers of trunk wood. I recovered a series of larvae and adults from the basal zone of a pine stump up to 11 cm in diameter. Weight of prepupae 84.0 to 223.5 mg, pupae 75.5 to 200.5 mg, and young beetles 60 to 160 mg. I found *Leptura quadrfasciata* L. and *Leptura melanura* L. on the same trees together with this species.

13. Genus *Eustrangalis* Bat.

Bates, 1884, *J. Linn. Soc. Lond. Zool.*, vol. 18, p. 221; Gressit, 1951, *Longicorn Beetles of China*, vol. 2, pp. 118-119.

Adult: Body elongate. Elytra markedly narrow posteriorly. Pronotum tubercularly projects laterally, characterized by broad flange on anterior margin and deep transverse groove basally.

Larva: Distinguished by locomotory ampullae on abdominal segments I to VII, coriaceous nonsclerotized eusternum, and other features.

Pupa: Characterized by elongate body, bulging frontal tubercles covered with thick setae, and urogomphi proximate at tip of abdomen.

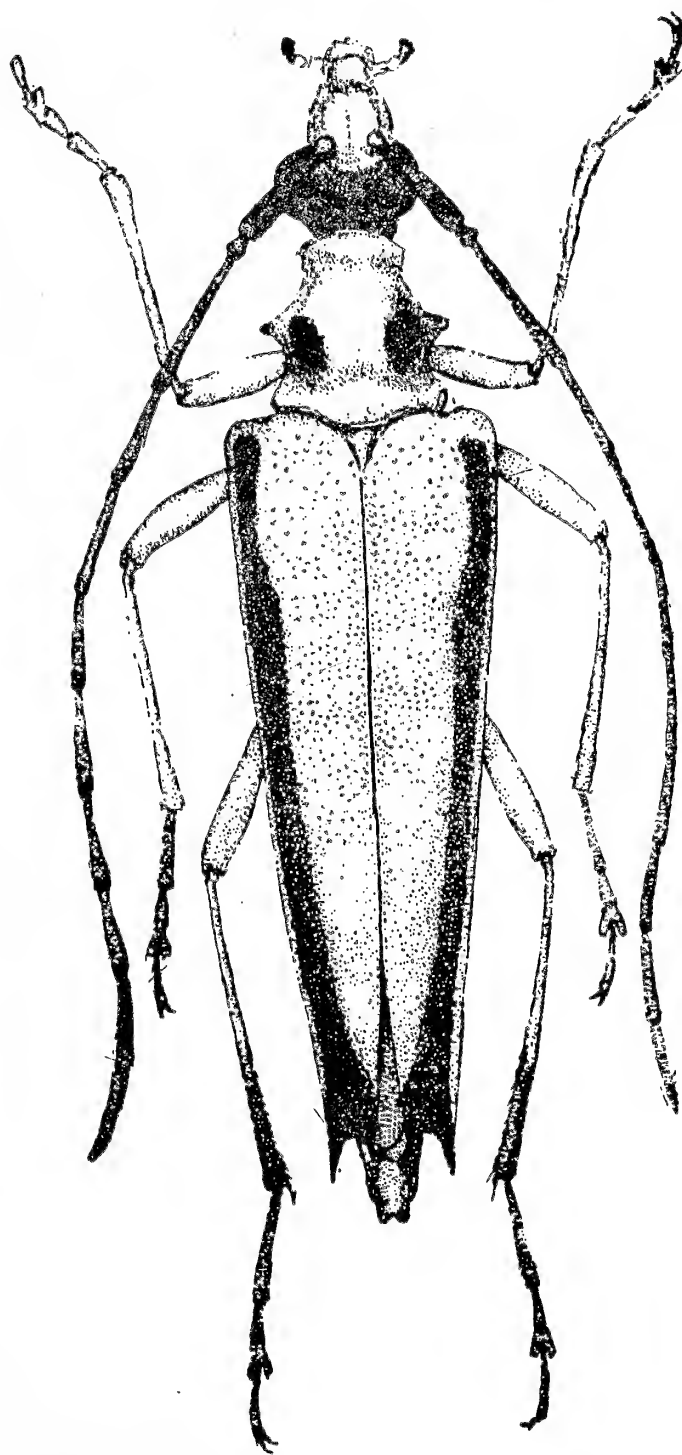
This genus is comparatively poor in species. Two species are known in Japanese fauna and less than ten in southeast Asia. Only one species is known in the faunal composition of Kunashir and Hokkaido Islands, which essentially represent the northern boundary of distribution of the genus *Eustrangalis*.

Type species: *Eustrangalis distenoides* Bates, 1884.

1. *Eustrangalis distenoides* Bat.

Bates, 1884, *J. Linn. Soc. Lond. Zool.*, vol. 18, p. 222; Kojima and Hayashi, 1969, *Insect Life in Japan*, vol. 1, p. 29; Krivolutskaya, 1973, *Entomofauna Kuril'skikh ostrovov*, p. 101.

Adult (Figure 254): Distinguished by yellow elongate body and very large black eyes. Head with fine punctation and short fine light-colored hairs; frons bulges laterally, with large raised tubercles and deep median longitudinal suture. Genae broad, slightly shorter than width of eyes; occiput steeply rounded; temples short, almost erect. Eyes bulge markedly, hemispherical, insignificantly elongate, finely faceted, narrowly emarginate on inner side. Antennae long, reach elytral apices (female) or cross them (male). Third segment of antennae longer than 4th, equal to 5th or slightly shorter.



Pronotum notably narrower anteriorly than posteriorly, with more or less projecting tubercle laterally, deep flange on anterior margin, deep transverse groove basally, bulges on disk, with large more (male) or less (female) close punctation, laterally with smooth circular blackened facet without punctation; posterior margin raised, with fine punctation, posterior angles slightly produced, almost rounded. Scutellum moderately elongate, triangular, narrowly rounded or pointed posteriorly.

391 Elytra elongate, markedly narrow from base to apex, with projecting humeral tubercles, broaden more at shoulders in female, obliquely and deeply notched apically, with subulate produced posterior angles covered with large deep punctation, minute punctation apically, with light-colored short and semiadherent hairs. Legs slender; hind femora reach only beyond 0.66 length of elytra; apex of hind tibiae in male on inner side with carinate longitudinal projection; hind tarsi thin, not longer than tibiae, 1st segment longer than all successive ones together. Abdominal tergite V elongate, rounded (male) or narrowly emarginate (female) at apex. Body bright yellow. Eyes, occiput, antennae, two round lateral spots on pronotum in posterior half, and posterior margin of abdominal segment V black. Elytra yellow, with sharp black band laterally extending from humeral tubercle to apex. Legs yellow; tarsi and tibiae in part brownish. Length of body 14 to 16 mm.

Larva (Figure 255): Characterized by developed locomotory ampullae on abdominal segments I to VII, three ocelli on each side of head at antennal bases, and coriaceous, nonsclerotized (without spinules)

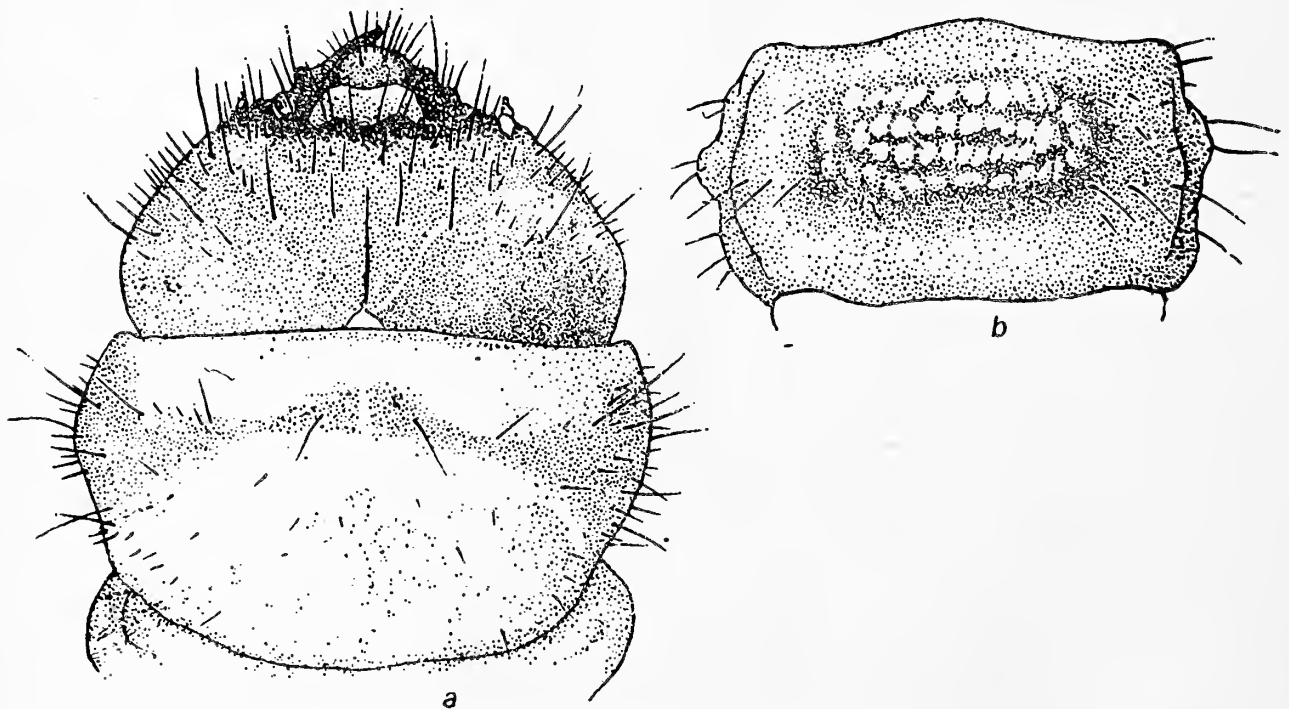


Figure 255. Larva of *Eustrangalis distenoides* Bat.

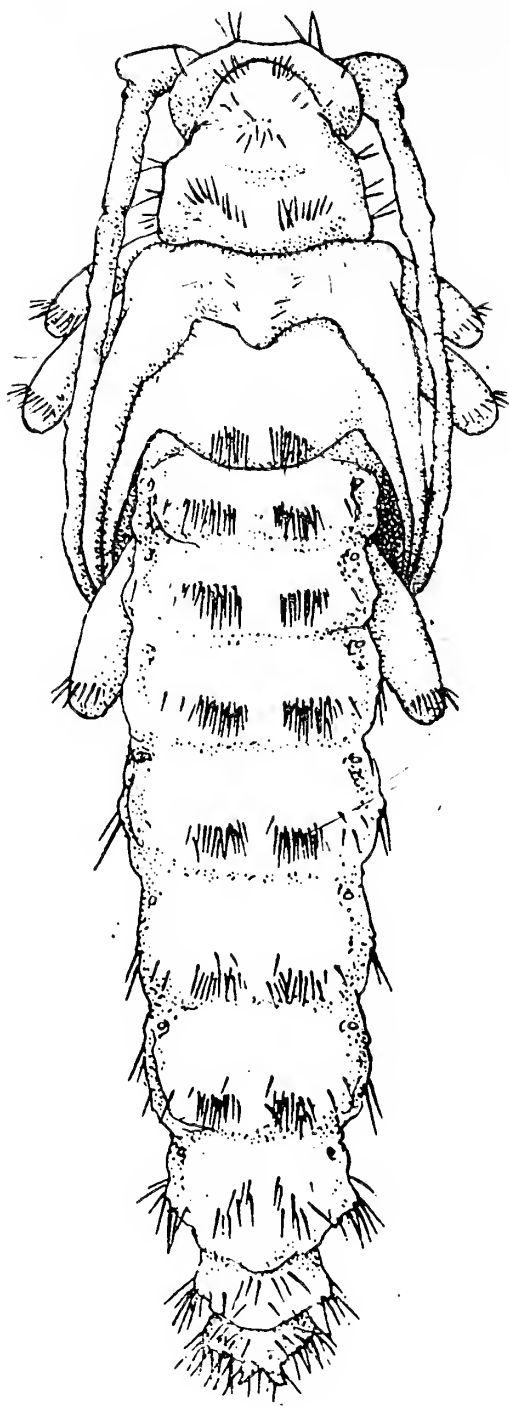
a—head and pronotum; b—abdominal tergite with locomotory ampulla.

eusternum. Head broad, narrows more anteriorly, with dense short setaceous hairs ventrolaterally. Three ocelli at each antennal base pigmented or lustrous and located in common depression forming transverse band. Epistoma flat, with short setaceous hairs in posterior half, four long hairs in front of middle forming transverse row, without white transverse band. Frontal sutures narrow in posterior half, insignificantly concave. Median longitudinal suture of epistoma obliterated in anterior half, faint. Hypostoma bulges, with white median longitudinal band; short setaceous hairs (16 to 20 hairs on each side of longitudinal band) almost cover surface and together with hairs laterally on head form common uniform pubescent field. Clypeus white, basally brownish. Labrum flat or bulges slightly, rusty-brown, apically whitish, broadly rounded with sparse setae along margins and much longer ones laterally. Mandibles taper toward apex, with markedly elongate lower denticle, longitudinal acute denticulate carina on inner cultrate section, and transverse, longitudinally striate impression on outer side.

Pronotum laterally rounded or slightly broadens anteriorly, matte in anterior half, with transverse lustrous yellow band forming laterally an extensive yellow facet and with insignificant white anterolateral notches. Pronotal shield bulges, white, lustrous, striate; bound laterally
392 by small longitudinal, slightly convex fold. Prosternum with sparse setaceous hairs. Eusternum bulges, coriaceous, lustrous, nonsclerotized, without spinules, but with three to four setaceous hairs along margins. Anterior clivus between thoracic legs and also anterior half of meso- and metanota sclerotized, with fine dense spinules.

Abdomen laterally with short sparse hairs. Dorsal locomotory ampullae well developed on abdominal tergites I to VII, with protuberant glassy granules forming two transversely elongate ellipses; rows of granules on inner ellipse proximate, lateral granules on outer ellipse separated by deep longitudinal fold. Ventral locomotory ampullae with protuberant granules forming two transversely divergent rows laterally. Lateral granules separated by short deep longitudinal fold. Abdominal tergite IX narrowly rounded posteriorly, with sparse short hairs in posterior half. Body length of mature larvae 22 mm, width of head 4.5 mm.

Pupa (Figure 256): Characterized by profuse growth of setae on frontal tubercles and presence of proximate urogomphi at tip of abdomen. Body elongate. Head short, with large hemispherical eyes, sparse long setae laterally in region of occipital protuberances, long thick setae
393 forming two longitudinally elongate tufts (seven to ten setae in each) at base of antennae on inner side of frontal tubercles, and six setae on anterior margin of frons forming transverse row interrupted medially (three setae on each side). Antennae flexed to sides, curved annularly in distal half.



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Figure 256. Pupa of *Eustrangalis distenoides* Bat.

Pronotum with parallel sides in posterior half, markedly narrows in anterior half, with broad flange on anterior margin, moderately bulges on disk; with long thin setae on anterior margin and in middle forming two tufts; steeply raised on posterior margin and here with large, very thick setae set on protuberant coriaceous base forming dense transverse band interrupted medially, and protruding slightly forward on each side. Mesonotum bulges, with thin setae laterally. Metanotum bulges, with narrow median longitudinal groove, and with setae in posterior half along sides of groove long and set on protuberant coriaceous base, forming dense tuft.

Abdomen elongate, gradually narrows posteriorly. Abdominal ter-

gites bulge behind middle and here with long paramedial setae bent posteroventrally set on protuberant coriaceous base, forming transversely elongate tuft (14 to 17 setae per tuft) on each side. Tip of abdomen with pair of proximate urogomphi directed laterally and terminating in acute sclerotized spinule. Facet on tip of abdomen (ventral view) bound laterally by projecting carina densely covered with long thin setae. Length of body 16 to 18 mm, width of abdomen 4.0 mm.

Material: Collected in Kunashir around Alekhino village. Adult insects six, larvae 47, pupae—five males and females, exuviae of larvae and pupae with beetles from cells six each.

Distribution: Kunashir (I found it in the environs of Alekhino village); Japan, including Hokkaido, Honshu, and Shikoku.

Biology: Inhabits broad-leaved forests. Ecologically associated with *Kalopanax septemlobum*. Flight of beetles occurs from July to middle 10 days of August. Beetles sighted on flowers of *Hydrangea paniculata* and other plants. Female lays eggs on trunk and branches of dead *Kalopanax septemlobum* trees 12 cm and more in diameter. I found larvae, pupae, and adults on trunks with bark partly preserved or peeled. Larvae live in wood, make L-shaped galleries (sometimes along and sometimes across trunk), and plug them densely with frass here and there (not throughout length) usually in a longitudinal direction. Part of gallery in transverse direction generally remains hollow, not choked with frass. Trunks up to 10 cm in diameter quite often bored straight through by such galleries. Width of gallery made by mature larvae up to 5.0 to 6.0 mm. Mature larvae make cell in wood along trunk at a depth of 5.0 to 10.0 mm, nibble an exit to trunk surface, leaving a wood layer about 3.0 mm thick outside, plug exit of cell with frass, and pupate. Length of cell 27 to 35 mm, width 7.0 to 8.0 mm.

Pupation commences early August and ends by September. Young beetles seen in September hibernate. I found on one and the same tree I-, II-, and III-instar larvae together with pupae and adults. This is proof that the tree was colonized repeatedly and that the life cycle is completed in two to three years. Weight of prepupae 80 to 230 mg, pupae 71 to 154 mg, and young beetles 55 to 129 mg.

8. Tribe NECYDALINI

Adult insects of the tribe Necydalini differ from those of other tribes in elongate cylindrical abdomen, shortened elytra and membranous wings free, folding unencumbered on abdomen.

Larvae characterized by presence of thoracic legs and sclerotization of lateral lobes on pronotum.

Pupae characterized by long lyriform urogomphi turned laterally at tip of abdomen.

The fauna of Necydalini is represented in Eurasia by a single genus (*Necydalis*) and in North America by two genera (*Necydalis* and *Ulochaetus*). The relative similarity between fauna of the Old and New World is preserved only at the level of generic transformation. In Eurasia the genus *Necydalis* comprises no less than 16 species and in North America seven species. Species of the tribe Necydalini common to these continents no longer exist.

1. Genus *Necydalis* L.

Linnaeus, 1758, *Syst. Nat.*, 10th ed., p. 10; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 461-464; Gressitt, 1951, *Longicorn Beetles of China*, vol. 2, p. 123; Kojima and Hayashi, 1969, *Insect Life in Japan*, vol. 1, p. 38; Linsley and Chemsak, 1972, *Cerambycidae of North America*, 69, 6 (1), 14-15.

Adult: Distinguished by short elytra, with apices not reaching beyond anterior margin of first abdominal segment. Hind membranous wings fall open on abdomen. Pronotum elongate, with broad flange in anterior third. Abdomen narrow and elongate.

Egg: Silvery-white, narrowly rounded at poles, with deep cellular sculpture forming longitudinal striation (*Necydalis* s. str.) or thin fine reticulate shagreen sculpture, not forming longitudinal striation (*Necydalisca*).

Larva: Characterized by intense sclerotization of prothoracic eusterium and presternum and locomotory ampullae of abdomen; white, coriaceous, moderately bulging pronotal shield; and fully developed hair cover on epistoma forming triangular field that extends posteriorly along medial suture.

Pupa: Body elongate. Pronotum elongate, bulges hemispherically in posterior half. Long coriaceous urogomphi at tip of abdomen terminate in short sclerotized brownish spinule usually bent ventrolaterally.

The genus *Necydalis* inhabits Europe, Asia, and America. Maximum numbers found in the Palearctic. The fauna of northern Asia comprises not less than four species ecologically associated with deciduous wood species. It should be noted that adult insects of species of the subgenus *Necydalisca* are characterized by great variability (instability) of features, making the identification of existing species difficult. This is the reason why extreme variants (ab. *eo*a Plav., ab. *ussuriensis* Plav., ab. *semenovi* Plav., ab. *pacifica* Plav.) are considered independent species.

Type species: *Necydalis major* Linnaeus, 1758.

KEY TO SPECIES

Adult Insects

- 1 (2). First abdominal sternite bulges, almost cylindrical, elongate, longer than wide. Elytra with fine, closely adherent golden plush hair cover (subgenus *Necydalis* s. str.). Length of body 21 to 32 mm. 1. **N. major** L.
- 395 2 (1). First abdominal sternite barely bulges, almost flat, not cylindrical, not longer than wide. Elytra without adherent golden plush hair cover, only with very dense erect hairs (subgenus *Necydalisca*).
- 3 (6). Elytra not elongate, obtuse at apex, with rounded, not projecting inner angles.
- 4 (5). Body large. Genae longer than half width of lower lobe of eye. Scutellum shortened, truncate; broadly, rarely narrowly rounded at apex. Length of body 17 to 26 mm. 2. **N. ebenina** Bat.
- 5 (4). Body comparatively short. Genae shorter than half width of lower lobe of eyes. Scutellum elongate, pointed or narrowly rounded at apex. Length of body 11 to 18 mm. 3. **N. morio** Kr.
- 6 (3). Elytra elongate at apex, with straight or projecting inner angles. Length of body 15 to 17 mm. 4. **N. sachalinensis** Mats. and Tam.

Larvae

- 1 (2). Pronotal shield bulges somewhat; anterior margin bound by large dark brown punctation forming transverse row produced anteromedially. Hypostoma bulges, distinctly narrows toward base. 1. **N. major** L.
- 2 (1). Pronotal shield barely bulges; anterior margin not bound by large punctation. Hypostoma bulges slightly, barely narrows toward base, with almost parallel sides.
- 3 (4). Eusternum not entirely sclerotized, peripherally bordered by white coriaceous nonsclerotized band. . . 2. **N. ebenina** Bat.
- 4 (3). Eusternum entirely sclerotized, without peripheral white coriaceous nonsclerotized band. 3. **N. morio** Kr.

Pupae

- 1 (2). Pronotum in posterior half with acute spinules almost throughout surface. Abdominal tergites on sides, posterior margin, and

- partly anterior half with highly numerous spinules, only middle of disk without spinules. 1. *N. major* L.
- 2 (1). Pronotum in posterior half with a few spinules forming two small tufts on disk and on posterior margin with transverse row or transverse band medially interrupted. Abdominal tergites glabrous on sides and in anterior half, without spinules, with insignificant number of spinules only in posterior half.
- 3 (4). Body comparatively large. Abdominal tergites II to IV in posterior half with five to seven lateral spinules directed backward. Tergite VIII with eight to ten spinules forming indistinct transverse row. Length of body 20 to 28 mm. 2. *N. ebenina* Bat.
- 4 (3). Body small. Abdominal tergites II to IV in posterior half with two to five lateral spinules, of which one to two usually large, rest small. Tergite VIII with four spinules forming transverse row, or without them. Length of body 13 to 19 mm. 3. *N. morio* Kr.

396 1. *Necydalis major* L.

Linnaeus, 1758, *Syst. Nat.*, 10th ed., p. 421; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 468-469; Cherepanov and Cherepanova, 1975, *Zhuki-drovoseki ivovykh lesov Sibiri*, pp. 80-83.

Adult (Figure 257): Body large. Head with parallel sides, divided by deep median longitudinal suture. Frons broad, with dense fine punctation, bound laterally by smooth longitudinal costate fold, demarcated anteriorly by two deep grooves diverging from middle laterally at right angle and joining with longitudinal folds. Clypeus with sparse fine punctation. Genae broad, notably shorter than wide, with close punctation. Temples with fine close punctation, produced, angularly rounded. Eyes broadly emarginate, finely faceted, almost 2.0 times longer than width of lower lobe. Antennae not long; tip of 8th (male) or 10th (female) segment reaches beyond elytral apex. Fourth antennal segment markedly thickens toward apex in male but mildly so in female.

Pronotum notably elongate, with broad deep flange in anterior third and less deep one in posterior third, markedly bulges on disk; with stray hairs, almost glabrous, smooth, lustrous, with very fine sparse punctation, close fine punctation on posterior and more projecting anterior margin, erect golden hairs laterally and in the region of transverse flange, and more or less distinct median longitudinal groove. Scutellum shortened, truncate posteriorly or rounded, usually with median longitudinal groove, and with dense hairs.

Elytra short, almost not longer than general width, taper on inner side toward apex, rounded on posterior outer angles; with tubercularly

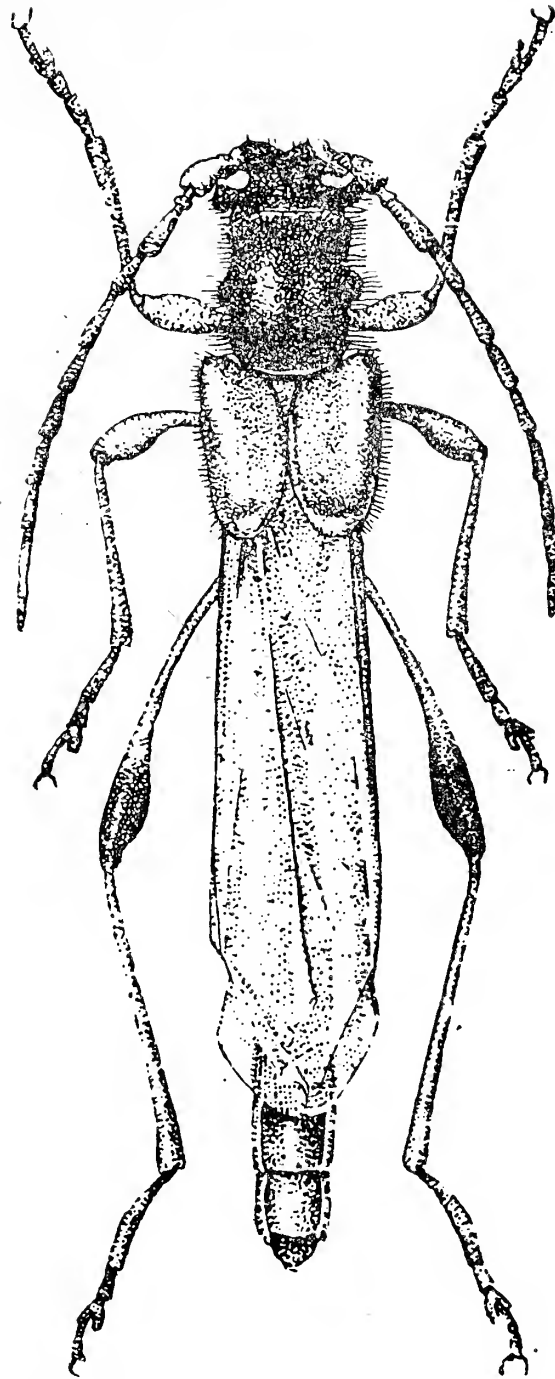


Figure 257. *Necydalis major* L.

projecting humeri; bound by continuous ridge, with large punctation laterally, longitudinal groove at suture covered with minute dense, closely adherent golden hairs directed every which way, in vortex, imparting iridescent golden hue. Legs long; hind femora clavate, hind tibiae considerably longer than tarsi.

Abdomen elongate; sternite I considerably longer than II, sternite V in male with parallel sides, with deep broad concavity at posterior margin. Abdomen sometimes covered with dense adherent light-colored hairs; flat in female, narrows posteriorly, notably elongate, straightly truncate or slightly emarginate at apex. Head, pronotum, scutellum, and underside of thorax black. Elytra reddish-rust, sometimes with

397 blackened apex. Abdomen black, often reddish-rust at base in region of sternites I to III. Antennae light rust or rusty-red, sometimes brownish apically. Legs light rust, apex of hind femora black. Length of body 21 to 32 mm.

Egg: Silvery-white, elongate, pointed at poles, flat on one side, bulges on the other, and narrows uniformly toward poles. Chorion with fine close longitudinally elongate cellular sculpture forming characteristic longitudinal striation. Length 2.9 to 3.0 mm, width 0.7 mm.

Larva (Figure 258): Readily distinguished by structure of pronotal shield, totally sclerotized eusternum, and well-developed bulging locomotory ampullae on abdominal segments I to VII. Body large, narrows anteriorly. Epistoma flat, dark brown on anterior margin, elsewhere light rust; anterior half behind brownish border with numerous setace-

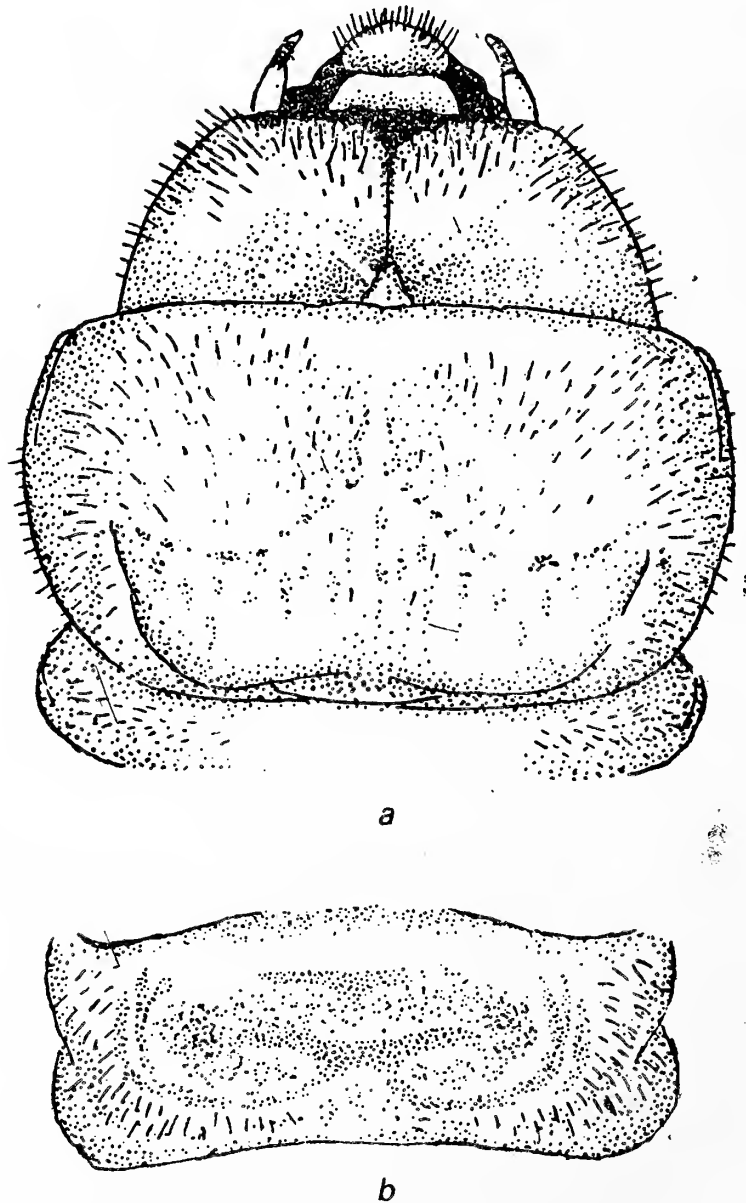


Figure 258. Larva of *Necydalis major* L.
a—head and pronotum; b—abdominal tergite and locomotory ampulla.

ous hairs, bound laterally by distinct frontal sutures, and divided medially by longitudinal suture, bordered by longitudinal well-developed impression along each side. Hypostoma bulges, slightly narrows posteriorly, rounded on notably produced anterior angles, divided medially by longitudinal gula, and with setaceous hairs in anterior half encircled at
 398 base by sclerotized rusty-brown ringlets. Clypeus white and trapezoidal, notably emarginate on anterior margin. Labrum laterally broadly rounded, bulges and glabrous on disk; with short setae along margins, brownish basally, and here with three lateral setae forming transverse row. Mandibles massive, black, taper toward apex, with acutely elongate lower denticle, and longitudinal carina on inner side.

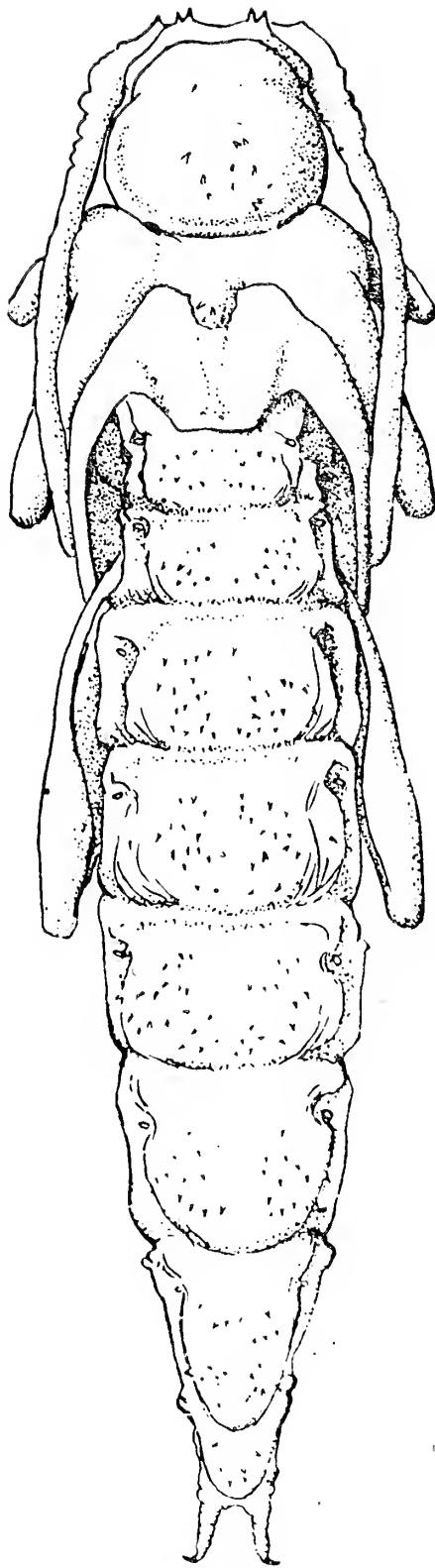
Pronotum transverse, slightly rolled anteriorly, with sparse short hairs laterally and in anterior half. Pronotal shield bulges, longitudinally striate, bound laterally by deep folds longitudinally diverging anteriorly, with two emarginations on anterior margin bound by brownish punctation, with produced anterior angles and pointed projection in middle. Prosternum with dense short light-colored hairs propleuron glabrous, lustrous. Eusternum entirely sclerotized, with sparse setae. Meso- and metanota shagreen, matte.

Abdomen gradually narrows posteriorly. Dorsal locomotory ampullae bulge, divided by median longitudinal groove, with minute sclerotized spinules, faint granules, and deep transverse groove arcing posterolaterally. Ventral locomotory ampullae divided by transverse groove, with granules forming two transverse rows (sternites I to IV) or one compact group on each side of longitudinal groove (sternites V to VII). Body length of mature larvae 35 to 45 mm, width of head 4.5 to 5.0 mm.

Pupa (Figure 259): Characterized by large, markedly elongate body, long urogomphi on tip of abdomen, and short highly numerous spinules on almost entire surface of posterior half of pronotum. Head short, with one to three spinules on occipital protuberances, bulging frontal tubercles at base of antennae covered with a few faint spinules, flat on anterior margin in front of frontal tubercles, and transversely striate. Antennae semicircular (male) or arcuate (female) in distal half.

Pronotum with broad flange in anterior third, hemispherically bulges in posterior half and here with acute spinules almost throughout surface; spinules directed from sides toward middle and from base forward; minute randomly distributed spinules on raised anterior margin. Mesonotum with projecting raised anterior margin covered with stray short thick spinules. Metanotum comparatively even (male) or impressed in second half, with minute spinules.

Abdomen markedly elongate, broadens slightly in region of segments II to IV, gradually narrows posteriorly. Abdominal tergites bulge



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Figure 259. Pupa of *Necydalis major* L.

moderately, slightly wider than long, slightly raised in posterior half, with numerous short acute erect spinules laterally and on posterior margin; rarely spinules directed inward, backward, and forward. Tip of abdomen with pair of long, widely separated, transversely striate urogomphi that terminate in acute sclerotized spinule bent laterally. Valvifers of female large, narrow toward base, with small round lateral projection at apex. Length of body 24 to 35 mm, width of abdomen 3.5 to 5.0 mm.

Material: From Altai, Tuva, and Ussuri-Primor'e region. Adult insects 36, including 22 raised in the laboratory, larvae 41, pupae—three males and nine females, exuviae of larvae and pupae with beetles from cells nine each.

399 *Distribution:* From Atlantic to Pacific Ocean coasts. In northern Asia covers forests from northern Kazakhstan, Altai, Tuva, Amur basin, and Primor'e in south to forest-tundra in north. Sporadic everywhere.

Biology: Inhabits deciduous vegetation. Ecologically associated with willow, linden, and other wood species. Flight of beetles commences in June and ends in first half of August. Beetles lead a cryptic mode of life, not seen on flowers. Reproduction commences soon after emerging from wood. Female lays eggs in bark crevices and fissures of dead trees. Quite often colonizes dead fallen trees. Development of eggs completed in three weeks. Under laboratory conditions larvae began hatching on March 31 from eggs laid March 10 to 13 at room temperature. Larvae live in wood, make longitudinal galleries, and plug them with fine frass. Galleries made in outer and also deeper layers of wood. Mature larva turns toward trunk surface, makes transverse exit, plugs it with frass by rotating its body, builds cell below along trunk, and pupates in it with head downward (opposite to exit).

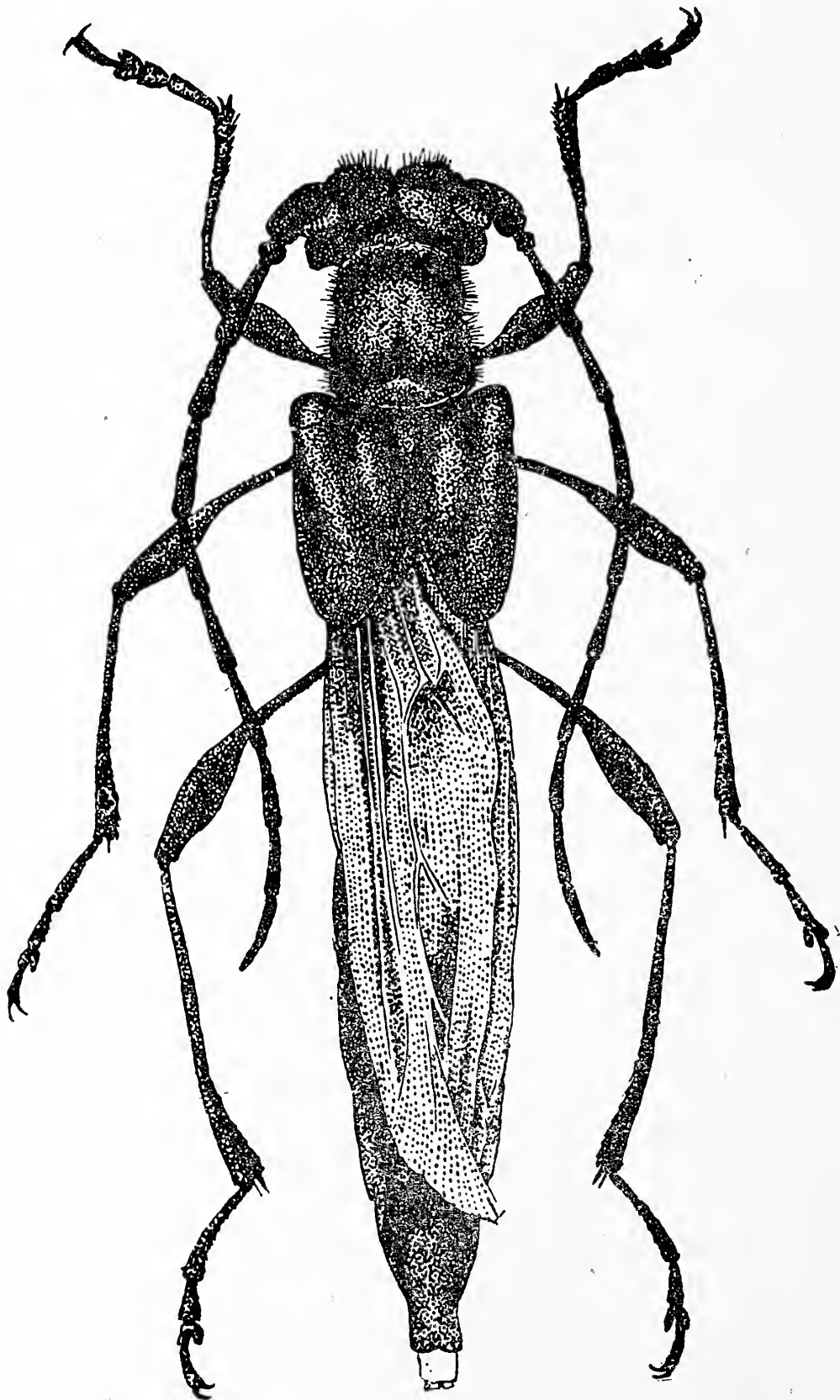
Pupation occurs in June. Pupae found up to early July inclusive. Young beetles seen in second half of June and in July. Duration of pupal stage not less than two weeks. Beetles that develop in pupal cells rotate their head toward exit, scrape frass from it, nibble round opening 5.0 mm in diameter on trunk surface and emerge. Length of gallery in wood 45 cm, width 8.0 to 10.0 mm; galleries made in wood at a depth of 1.5 to 15.0 cm. Length of pupal cell 35 to 40 mm, width 8.0 to 14.0 mm. Beetles emerge from wood with developed gonads and mate immediately (without supplementary feeding). Ovaries of one female just emerged from wood contained 50 fully developed eggs. Weight of larvae before pupation 125.5 to 810.0 mg (average 403.5 mg), pupae 106.9 to 610.0 mg (366.7 mg), and beetles before emerging from wood 88.8 to 481.9 mg (average 268.5 mg). During metamorphosis weight of insects fell by an average of 33.5%, in some instances by 40.9%.

Trunks of many deciduous wood species colonized by a large number of short-winged woodborers. I collected larvae, pupae, and beetles from nine wood species including birch (31 specimens), linden (4), alder (19), willow (7), maple (3), ash (1), oak (8), aspen (2) and bird-cherry (1), total 76. They colonize lower root zone as well as upper trunk of dead trees. Larvae were once found on a burl of dead birch at a height of about 9.0 m. Weakened viable trees are not inhabited by this species. *Necydalis ebenina* Bat, *N. morio* Kr., *Leptura thoracica* Creutz., and others are found together with this species on the same dead trees.

2. *Necydalis ebenina* Bat.

Bates, 1884, *J. Linn. Soc. Lond. Zool.*, vol. 18, p. 225; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 469-470; *eo*a, Plavilstshikov [Plavil'shchikov], *ibid.*, pp. 470-471.

Adult (Figure 260): Readily distinguished from *Necydalis major* L. by very coarse erect hair cover on elytra, short abdominal sternite,



I, and other features. Body comparatively large. Head with deep median longitudinal suture and sometimes smooth band, without punctation at this site on vertex. Frons tapers slightly, with deep dense, usually uneven punctation, bound laterally by smooth longitudinal carinae, antennal bases diverge slightly toward outer margin, and bound anteriorly by transverse roundly or angularly concave suture. Clypeus with deep sparse punctation, transversely impressed at base, lustrous along anterior margin. Genae long, usually longer than width of lower lobe of eye. Temples thick, rounded laterally, with fine close punctation imparting matte tone. Eyes elongate, large, with broad notch on inner side in upper half. Sixth (male) or 7th (female) antennal segment reaches beyond apex of elytra. Antennae matte from distal half of 5th segment, with very fine punctation and short semiadherent hairs.

Pronotum slightly longer than width at base, deep comparatively broad flange on anterior margin, broad but not very deep transverse groove at base; bulges, smooth, lac-lustrous on disk; with median longitudinal groove, dense deep punctation (male) on bent anterior margin and especially at base (even in region of transverse groove) and laterally, or sparse fine punctation on anterior margin and at base and much larger punctation laterally (female). Scutellum broad, not elongate, rounded or straightly truncate behind, with close fine punctation and usually light-colored hairs.

Elytra short, with projecting humeral tubercles, notably impressed behind scutellum on suture on inner side of humeral tubercle and before apex, taper on inner side commencing from middle, rounded or obtuse apically; with dense deep, more or less large punctation, finer punctation on posterior protruding end. Metathorax with dense striate coarse punctation. Legs slender; hind femora, clavate, apex reaches considerably beyond abdominal sternite III (male) or does not reach its posterior margin (female).

Abdomen elongate. Abdominal sternite I flat or bulges slightly, slightly longer than II, with fine close punctation imparting (especially in female) shagreen matte tone. Abdominal sternite V in male not longer than wide, narrowly rounded posteriorly, gently notched on posterior margin, with longitudinal or oval dents laterally. Sternite V in female elongate, notably longer than width at base, markedly narrows posteriorly, notched or straightly truncate at end; with close fine punctation in anterior half, especially laterally, and sparse punctation at apex. Body, elytra, legs, and antennae black (f. *typica*); often body black, elytra reddish-rust or light chestnut, and legs rusty-yellow. Bases of antennae up to 5th segment inclusive light rust, elsewhere blackish-brown (ab. *eo*a Plav.). Sometimes abdomen entirely reddish-brown. Specimens found in which elytra reddish-rust with blackened apex and

legs rusty-yellow. Apex of hind femora blackened, or body, legs, and antennae black; elytra black with rusty spot on suture of scutellum. Length of body 17 to 26 mm.

Observations in nature and experiments conducted by me under laboratory conditions from 1971 to 1975 established biological compatibility between specimens of *N. ebenina* Bat. and *N. eoa* Plav.; they mate freely and the female lays eggs on colonized trees. These observations support their placement in a single species.

Egg: Silvery-white, elongate, narrows identically toward both ends, narrowly rounded at poles. Chorion with fine reticulate shagreen sculpture that does not form longitudinal striation. Length 2.0 mm, width 0.5 mm.

Larva (Figure 261): Differs from other species of this genus in eusternum with white coriaceous nonsclerotized border along entire circum-

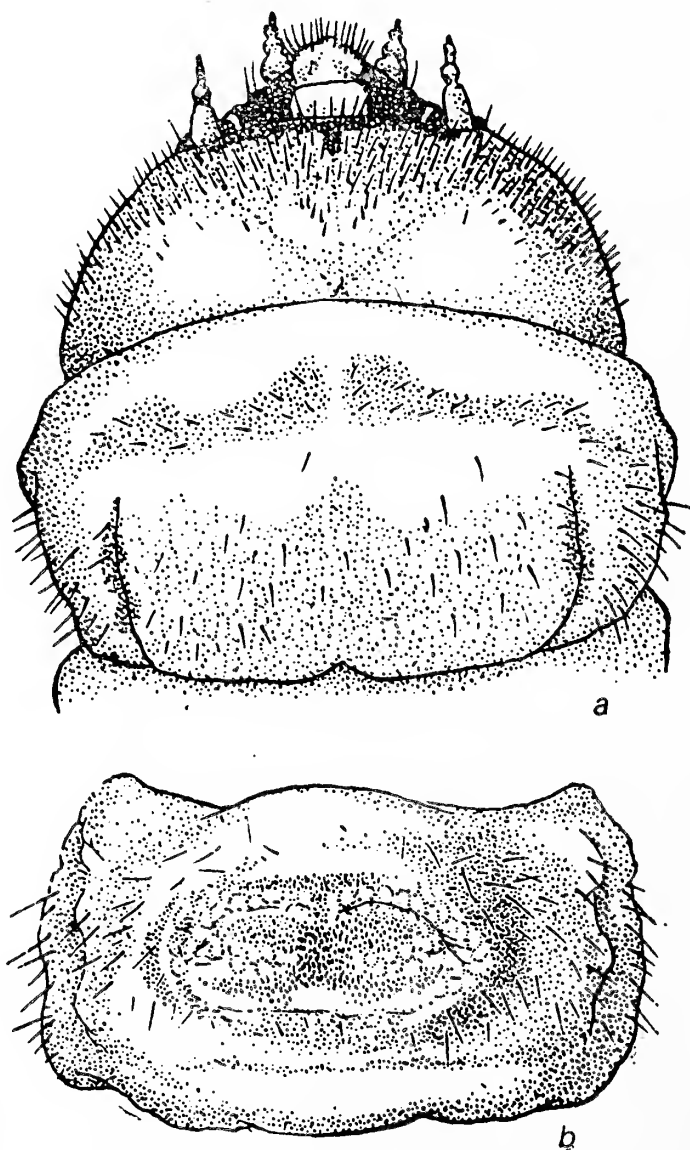


Figure 261. Larva of *Necydalis ebenina* Bat.
a—head and pronotum; b—abdominal tergite
with locomotory ampulla.

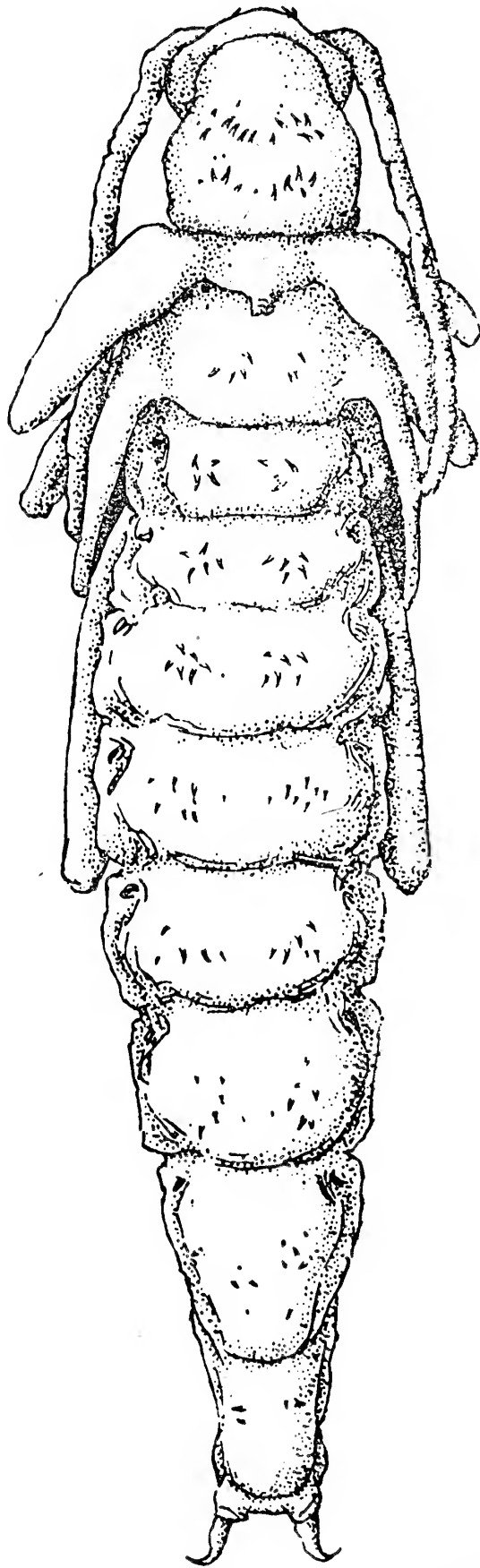
ference, densely pubescent hypostoma, and structure of dorsal locomotory ampullae. Head narrowly rounded anteriorly, with dense short hairs in anterior half laterally and long ones around antennae. Epistoma in posterior half flat, slightly impressed, with dense hairs in anterior half forming triangular field on each side of medial (longitudinal) suture that extends posteriorly along suture. Moreover, anterior hairs long, posterior ones at suture short. Frontal sutures indistinct, sometimes almost imperceptible. Medial suture dark brown, well developed throughout its length. Hypostoma bulges, with parallel sides; dense setaceous hairs form continuous broad field that covers most of hypostoma. Gula broad, bulges, with five to seven hairs, rarely less. Clypeus white, bulges, with parallel sides or slightly narrows anteriorly. Labrum white, broadly rounded on anterior margin, with long dense setae; glabrous, lustrous, bulging on disk; brownish at base. Mandibles thick, with acutely produced lower denticle, triangularly notched at apex upward; additional denticle located in middle of this notch in cultrate edge; four parallel carinae on inner side, of which middle ones longest.

Pronotum bulges moderately, flattened on anterior half of disk, with broad transverse, bright or dull yellow band, numerous long rusty hairs laterally and on disk in front of middle (at site of yellow band). Pronotal shield white, bulges more, striate, coriaceous at base, in some specimens with dispersed setae directed backward; lateral longitudinal sclerotized folds covered by dense spinules forming longitudinal rusty-yellow band. Prosternum with numerous short setaceous hairs, sclerotized, variegate (white coriaceous nonsclerotized fields prominent on general yellow sclerotized background). Eusternum yellow, sclerotized, with minute dense spinules, with white coriaceous nonsclerotized border peripherally, and minute rusty setae on sclerotized field. White border sometimes broad (especially at base of eusternum), sometimes very narrow, but invariably quite distinct.

Abdomen more or less elongate, with short yellowish hairs laterally. Dorsal locomotory ampullae bulge uniformly, divided by broad median longitudinal groove, sclerotized in patches, and with minute spinules; transverse bracket-shaped groove separates two indistinct rows of nonsclerotized granules and hence contrasting white transverse strip with lateral and inner branchings diverging from it posteriorly prominent against general yellow background of dorsal locomotory ampullae. Locomotory ampulla on tergite VII in form of transversely elongate, partly granulate elevation, with yellow sclerotized band in posterior half. Ventral locomotory ampullae with white dense granules forming along sides of longitudinal groove transversely elongate or oval, almost circular group surrounded by sclerotized spinous yellow field. These granular groups, especially on locomotory ampullae of abdominal ster-

nites I to II, join to form common white transverse band. Length of body 33 mm, width of head 3.5 mm.

Pupa (Figure 262): Similar to pupa of *Necydalis morio* Kr. Differs from it in large dimensions and large developed spinules on abdominal



tergites. Head behind antennae transversely impressed, with one or two large spinules posterolaterally bent down and inward, and broad median longitudinal suture between antennae. Antennae semicircular in distal half, flexed ventrad to elytra.

Pronotum narrows slightly more anteriorly than posteriorly, in anterior third sometimes with very deep and sometimes shallow but broad flange, bulges uniformly in posterior half, with median faint longitudinal groove and seven to nine large acute spinules directed inward posteriorly or erect along sides of groove on disk, and 12 to 14 spinules erect or directed forward on posterior margin forming transverse row or transverse band interrupted medially. Anterior half of pronotum glabrous, without spinules. Mesonotum bulges slightly, with markedly produced anterior margin. Metanotum bulges insignificantly, almost flat, with one or two to three small paramedial spinules.

Abdomen markedly elongate, narrows very slightly anteriorly, more so posteriorly. Abdominal tergites transverse, 2.0 times wider than long, bulge, with five to seven spinules along sides of longitudinal groove in posterior half directed backward, sometimes set on common coriaceous base. Tergite VII narrows toward apex, narrowly rounded posteriorly, barely elongate, almost not longer than width at base, with large (up to four) and small (up to five to ten) spinules in posterior half directed every which way. Tergite VIII elongate, with eight to ten spinules in posterior half forming indistinct transverse row. Tip of abdomen with widely separated urogomphi terminating in one brownish sclerotized spinule bent downward. Valvifers of female massive, intercepted basally, with apices markedly shifted laterally and inclined at an obtuse angle (valvifers in *N. morio* Kr. diverge laterally at a right angle). Length of body 25 mm, width of abdomen 5.5 mm.

Material: From Ussuri-Primor'e region and Kunashir. Adult insects 26, larvae 31, pupae—two males and five females.

Distribution: Ussuri-Primor'e region (Vladivostok, Kondratenovka village, and Komarovka River), Kunashir; Japan.

Biology: Found sporadically in broad-leaved forests; comparatively rare. Trophically associated with ash, alder, oak, and other wood species. Beetles sighted in June and found up to end of August, usually not seen on flowers, and survive for two to three weeks. Female lays eggs in bark crevices and wood fissures of trees 30 cm or more in diameter. Embryonic development from time of oviposition to hatching of larvae under gently sloping forest cover took 11 to 19 days. From eggs laid June 18 to 22 larvae began hatching on July 3rd; from eggs laid June 22 to 27, on July 9th through 14; and from eggs laid June 30 to July 3rd, commenced hatching on July 14. Atmospheric temperature during this period was 4.7°C in the morning to 34.2°C during the day, with mean temperature 19.6°C.

Larvae live in wood for not less than three years, making galleries from bottom upward along trunk axis at a depth of 5.0 to 15.0 cm, sometimes near pith, and plug them densely with fine frass. Galleries in thick-trunked trees disposed along periphery and form continuous ring consisting of oval perforations plugged with frass in a cross section of the trunk. Total length of longitudinal galleries over 40 cm, maximum width 15 mm. Larvae of different generations develop on the same tree. Mature larva before pupation makes hollow exit, not plugged with frass, either horizontal or oblique to trunk surface, leaving a layer of wood outside 1.0 mm in thickness or more. Length of hollow transverse exit 5.0 to 10.0 cm, width 10 to 12 mm. Pupal cell formed at end of longitudinal gallery, with exit toward trunk surface plugged with frass. Length of cell 39 to 45 mm, width 10 to 14 mm. Larva pupates in cell with head downward.

Pupation commences after third or fourth hibernation. For example, from larvae collected from wood cuttings of maple in 1972, pupae and adults developed in 1975. In forests in far eastern Primor'e in 1973 to 1974 pupation of larvae was recorded in June and July and pupae found up to the end of July. Beetles emerge three weeks after pupation. Rotating the head upward they abandon the pupal cell through its transverse exit and seven or eight days later nibble an opening 3.0 mm × 3.5 mm to 4.0 mm × 5.0 mm on trunk surface and escape. Emergence of beetles from wood in 1973 commenced around June 20 and ended in early August. Beetles emerging from wood in gardens mate immediately and the female lays eggs without supplementary feeding. Weight of larvae before pupation 242 to 441.8 mg (average 322 mg), pupae 220 to 397 mg (281.3 mg), and young beetles before emerging from wood 135 to 316 mg (214.3 mg). During metamorphosis the overall weight of insects decreases by 33.5%. Development proceeds in dead but very solid wood of standing trees. Not found in dead fallen trees. Analysis of wood from 1972 to 1974 revealed 19 insects in ash, 27 in alder, nine in oak, six in maple, and two in bird-cherry; total 63 (larvae and pupae); from these, 25 beetles were raised in the laboratory. *Callipogon relictus* Sem. sometimes colonizes thick trunks of oak together with this species, and *Rosalia coelestis* Sem. Manchurian striped maple. None of them colonize viable trees.

3. *Necydalis morio* Kr.

Kraatz, 1879, *Deutsch. Entom. Z.*, vol. 23, p. 106; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 471-472; *pacifica*, Plavilstshikov [Plavil'shchikov], *ibid.*, pp. 472-473; *ussuriensis*, Plavilstshikov [Plavil'shchikov], *ibid.*, pp. 473-475; *semenovi*, Plavilstshikov [Plavil'shchikov], *ibid.*, pp. 475-477.

Adult (Figure 263): Characterized by extraordinary variability of color of abdomen, elytra, and legs. Body not large, elongate. Head short, with median longitudinal suture. Genae shorter (male) or almost
405 not shorter (female) than half width of lower lobe of eyes, with large punctation. Frons broad, with smooth deep lateral longitudinal fold, markedly bulges at base of antennae, with close deep punctation. Clypeus transversely impressed at base, raised anteriorly, with sparse punctation. Temples angularly produced but rounded laterally, with dense uneven, sometimes very fine, fused punctation. Antennae comparatively

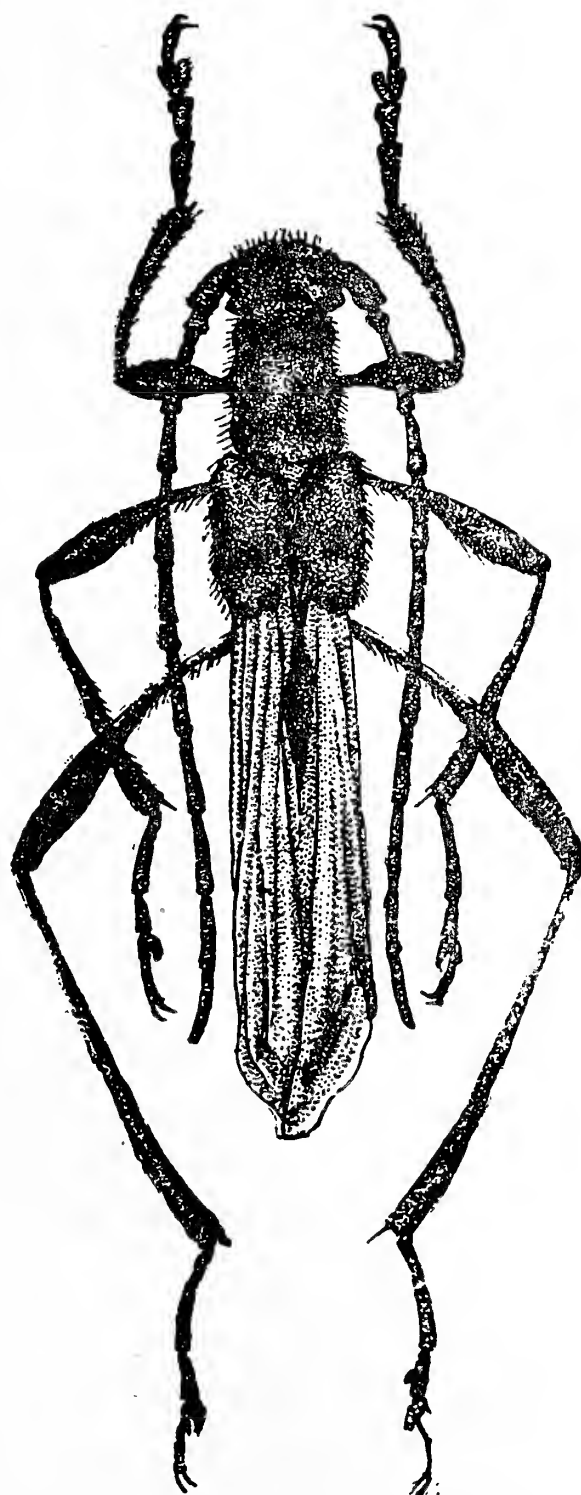


Figure 263. *Necydalis morio* Kr.

thin, with 6th (male) or 7th (female) segment reaching elytral apex. Fifth antennal segment longest, equal to 2nd and 3rd together, rarely slightly shorter; 11th segment with perceptible subapical constriction (female) or without it (male), sometimes elongate, sometimes shortened.

Pronotum elongate, in anterior third with broad, basally with narrow flange, slightly enlarged mediolaterally, bulges on disk, with very sparse, extremely fine (obliterated) punctation, dense large punctation in male and sparse fine punctation in female in posterior third, especially behind constriction, and generally dense punctation laterally. Scutellum usually elongate, almost horizontal in distal half, pointed or narrowly rounded apically, sometimes with median longitudinal groove, with close punctation, and dense hairs.

Elytra very short, with parallel sides, gape at suture almost from scutellum, markedly taper posteriorly on inner margin, obtuse at apex, rounded on posterior angles, with smooth lustrous humeri projecting anteriorly; with large deep very close (male) or slightly diffuse (female) punctation (spaces between them usually small or even smaller than punctures per se). Legs long and slender. Hind femora clavate, with apices reaching beyond middle of segment III (female) or IV (male) of abdomen; hind tibiae considerably longer than tarsi. First segment of hind tarsi longer than all other segments together, 2nd half length of 3rd or, as an exception equal to it. Metathorax (ventral view) bulges markedly, with narrow median longitudinal groove, and dense large and small punctation. Metathoracic episterna with dense uneven rugose punctation.

Abdomen elongate, abdominal sternites bulge moderately, matte, with very fine close punctation. Abdominal sternite V in female almost not longer than width at base, narrows from base posteriorly, slightly emarginate or almost straightly truncate on posterior margin, transverse in male, narrowly rounded and bulges toward posterior margin, with longitudinally elongate and highly variable dent laterally at base, and deep notch in posterior margin. Head, pronotum (especially antero- and posterolaterally), and elytra with erect light-colored usually dense hairs. Body, antennae, elytra, and legs black (*f. typica*). Often body black, elytra reddish-rust, and legs yellowish-rust; sometimes apices of
406 hind femora and tibiae as well as hind tarsi blackened, antennae black, reddish-rust or yellow at base up to proximal half of 5th segment inclusive (*ab. ussuriensis* Plav.); rarely elytra darkened at base and apex (*ab. pacifica* Plav.). Sometimes body black, elytra rusty-yellow, legs light yellow or light rust, and abdomen entirely yellow (*ab. semenovi* Plav.). Specimens found with black abdomen with rusty tinge only at base or with yellow abdomen blackened at tip, or with yellowish-rust abdomen

in which sternites darkened posteriorly. Gradual color transition seen in small series. Length of body 11 to 18 mm.

In several experiments conducted with different variants, emerging beetles of one aberration mated freely with those of other aberrations; later the female laid eggs from which normal larvae hatched. My investigations from 1971 to 1973 in forests of Ussuri-Primor'e region revealed that all these aberrant forms develop on the same trees simultaneously, and are monotypic in phenological and other biological characteristics. Thus they belong to the same species.

Egg: White, markedly elongate, narrowly rounded identically at poles. Chorion with fine shagreen reticulate sculpture, coarser at poles. Length 2.1 mm, width 0.5 mm.

Larva (Figure 264): Characterized by absence of brownish spots on anterior margin of pronotal shield, wide sclerotization of locomotory ampullae, and transverse yellow band in anterior third of pronotum. Head narrowly rounded anteriorly, with minute, sometimes even prominent, hyaline transversely elongate ocellus at base of antennae, and short setaceous hairs laterally in anterior half forming triangular field with apex directed backward. Epistoma flat, slightly concave apically, bound laterally by faint frontal sutures, divided medially by brownish-yellow longitudinal suture uniformly developed throughout its length; highly numerous setaceous hairs in anterior half form dense transverse band interrupted by narrow interception in region of longitudinal suture. Hypostoma bulges slightly, with parallel sides or slightly enlarged anteriorly, acutely produced anterior angles that are not rounded, and

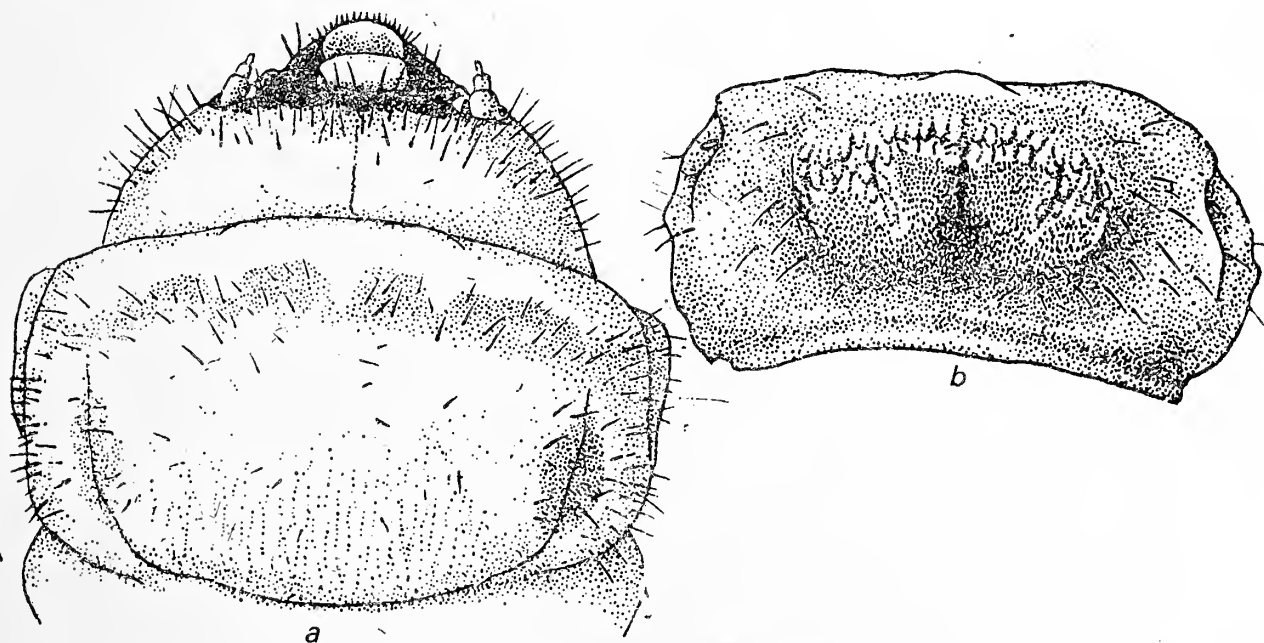


Figure 264. Larva of *Necydalis morio* Kr.
a—head and pronotum; b—abdominal tergite
with locomotory ampulla.

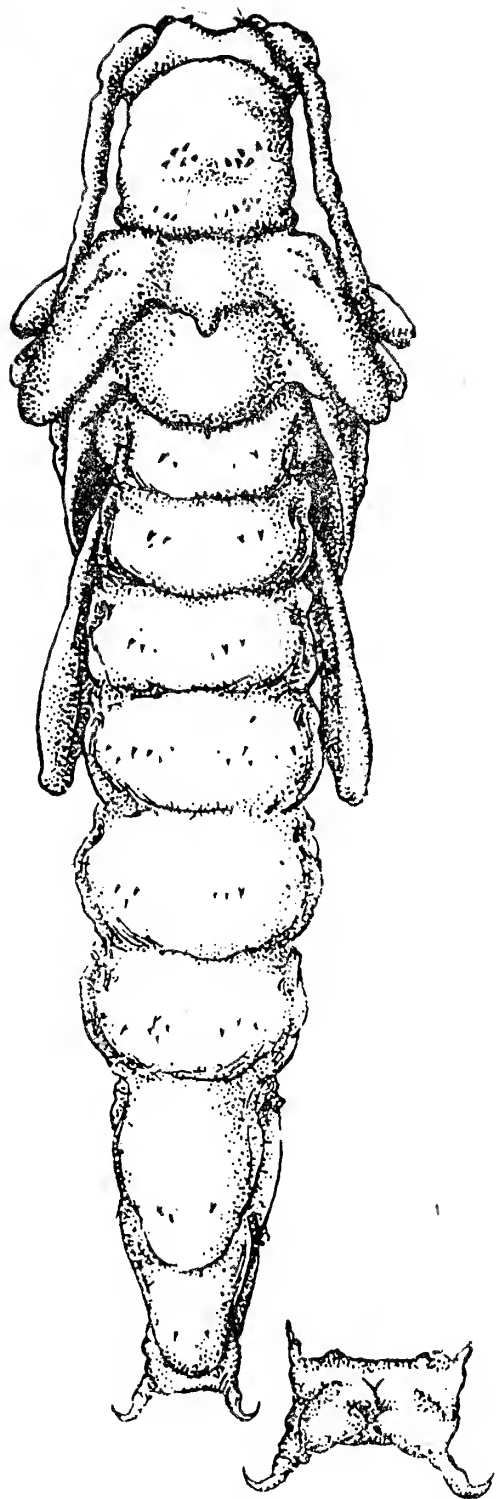
divided medially by broad longitudinal gula; very dense setaceous hairs in anterior half form common transverse field in which three more or less distinct transverse rows discernible. Clypeus bulges, slightly narrows anteriorly, white, lustrous, with sharp dark brown transverse band basally. Labrum transversely oval, broadly rounded on anterior margin, with dense setae; bulges, glabrous, lustrous, and white on disk, brownish at base. Mandibles taper toward apex, with projecting lower denticle, apically triangularly notched upward; inner side with elongate facet with fine longitudinal carinae.

Pronotum bulges moderately, with broad transverse yellow band in anterior half anterior to middle, thin rusty hairs laterally and on disk in region of yellow band, and broad milk-white border on anterior margin. Pronotal shield bulges, white, striate, with slightly demarcated anterior margin and here with stray setaceous hairs; laterally with short longitudinal, highly sclerotized folds diverging anteriorly and covered with minute brown spinules forming oblique longitudinal band. Prosternum with highly numerous even setaceous hairs and very minute, very dense spinescent setae imparting yellowish sclerotized tone. Proplesternum glabrous, without hairs. Eusternum bulges, entirely sclerotized, with very fine spinules and highly numerous setaceous hairs. Meso- and metanota sclerotized, yellow.

Abdomen laterally with very sparse short light-colored hairs. Dorsal locomotory ampullae bulge, sclerotized, with fine spinules, divided by common median longitudinal groove, with transverse groove laterally curved backward and inward, and slightly convex lateral longitudinal folds. Transverse groove and lateral folds bordered by minute hyaline granules. Ventral locomotory ampullae sclerotized peripherally, yellowish, and divided by transverse groove beset with granules forming two transverse rows on first two sternites or, contrarily, two ellipsoidal transversely elongate or round groups. Body length of mature larvae 29 mm, width of head 3.5 mm.

Pupa (Figure 265): Differs from pupa of *Necydalis major* L. in smaller dimensions and smaller number of spinules on abdominal tergites. Body markedly elongate. Head short and moderately bent under, with slightly raised frontal tubercles devoid of spinules, but one or two spinules along sides of occipital protuberances bent down and inward. Antennae flexed to sides, semicircular in distal half.

Pronotum slightly longer than wide, with broad shallow flange in anterior third, bulges hemispherically in posterior half on disk, and here with five paramedial spinules bent inward forming a tuft; similar tuft of spinules at base bent forward and inward; anterior margin and region of flange glabrous, without spinules. Mesonotum bulges, lustrous, smooth, without perceptible spinules. Metanotum bulges slightly, with



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Figure 265. Pupa of *Necydalis morio* Kr., female.

shallow median longitudinal groove, and laterally with one to two spinules bent backward or erect.

Abdomen narrowly elongate, in region of segments III to V broadens slightly, gradually narrows posteriorly. Abdominal tergites bulge uniformly, with faint common median longitudinal groove, laterally with two to five acute spinules directed backward, of which one to two large, the rest small. Tergites VIII with four erect spinules in transverse row, rarely without them (female). Tip of abdomen with pair of widely separated coriaceous urogomphi terminating in an acute sclerotized

spinule directed ventrad. Valvifers of female large and thick, with apices widely shifted laterally, and clavate process at end. Length of body 18 mm, width of abdomen 3.0 to 3.5 mm.

408 *Material:* From Ussuri-Primor'e region. Adult insects 106, larvae 93, pupae—four males and four females.

Distribution: Ussuri-Primor'e region, including Vladivostok, Komarovka River, Partizan, Osinovka, Kondratenovka, Rekord Island, and Khabarov.

Biology: Occupies broad-leaved forest biotopes. More numerous compared to *Necydalis ebenina* Bat. Flight of beetles occurs in June and July. Beetles lead a cryptic mode of life. After emerging from wood, they fly to trees, mate there, and on the same or following day female commences oviposition. For example, in the laboratory one female emerging from wood on March 16, after mating on the 18th laid 10 eggs; another female after emerging from wood on March 19 mated the same day. Ovaries of one female dissected seven days after emerging from wood contained 60 eggs. Standing trees are colonized and eggs laid in bark crevices and wood fissures in trunks of deciduous wood species. In the laboratory at 14 to 19°C (average 17.2°C) egg development took 11 to 18 days.

Larvae live in solid nondecomposed wood, make longitudinal galleries in upper layer to a depth of 2.0 cm or slightly more, and plug them densely with fine frass. Width of gallery made by mature larvae 4.0 to 6.0 mm. Cell made along trunk at end of gallery. Length of cell 24 to 25 mm, width 6.0 to 8.0 mm. Larva makes exit from cell (at upper end) to trunk surface and plugs it from inside with frass, forming a hard stopper that protects the cell from external elements. Length of exit 15 to 22 mm. Larva pupates in cell with head downward.

Pupation of larvae commences after third hibernation and even after fourth in some cases. Thus larvae collected from nature in 1971 pupated in 1974, while those collected in 1972 transformed into pupae in 1975. Pupae seen at end of May and found up to July. For example, on June 3rd two pupae and one beetle were found in wood of a dead elm and 409 live beetles recovered on June 29 from an oak stump. Beetles of different hibernations recovered from the same trees. They freely mate among themselves and the female lays eggs. Pupae develop in about three weeks. Young beetles emerging from them turn their head upward, remove frass from exit of pupal cell, make an oval opening (3.0 mm × 4.0 mm) on trunk surface, and emerge. Male weighs considerably less than female (Table 13), which is also true of other species of the genus *Necydalis*.

Necydalis morio Kr. inhabits many deciduous wood species but prefers oak and maple. Thus in collecting specimens 87 were found on oak,

Table 13. Weight indexes of *Necydalis morio* Kr. (mg)

Sex	Larvae before pupation	Pupa	Beetles emerging from wood
Male	61.3 (30-98)	54.3 (27-88)	39.7 (21-55)
Female	114.6 (68.0-199.3)	102.2 (61-169)	79.5 (48-120)

Note: Range shown in parentheses.

62 on maple, 16 on alder, 12 on ash, 14 on *Micromeles alnifolia*, three on linden, eight on Amur choke-cherry, four on elm, and one on apricot; total 207 larvae and pupae, of which 106 beetles were raised in the laboratory. *Aglaophis colobotheoides* Bat. and *Rhaphuma acutivittis* (Kr.) found in wood of the same trees together with this species.

4. *Necydalis sachalinensis* Mats. and Tam.

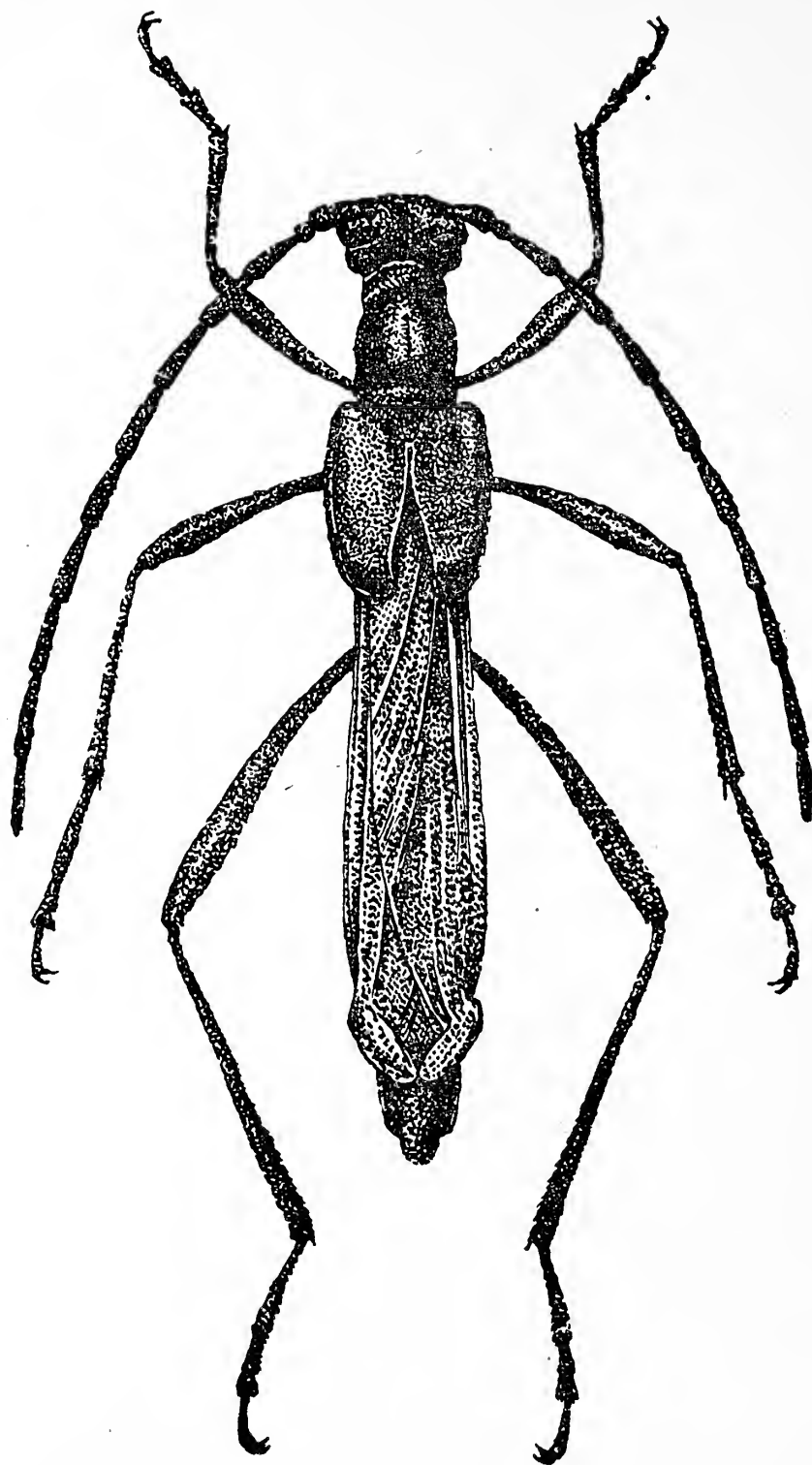
Matsumura and Tamanuki, 1927, *Ins. Matsum.*, vol. 1, p. 176; Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 477-478.

410 *Adult* (Figure 266): Readily distinguished from other species by structure of elytra. Head comparatively short, divided by median longitudinal suture; punctation dense, uneven, rugose. Clypues with moderately close, not very dense punctation. Genae not longer than half width of lower lobe of eyes, with coarse punctation. Temples finely punctate, almost matte, produced laterally, and more (female) or less (male) thickened. Antennae extend beyond base of elytra by their 5th (male) or 6th (female) segment. Third antennal segment notably shorter than 5th, slightly longer than 4th or 1st.

Pronotum elongate, with broad and comparatively deep flange in anterior third, more or less sharp transverse groove at base; punctation sparse on anterior margin, denser laterally, large and dense, at places fusing, on posterior margin and middle region of transverse groove; bulges, smooth, lac-lustrous on disk, with very fine obliterated punctation, and short median longitudinal groove.

Elytra short, not longer or only slightly longer than total width at base, with minute rugose punctation; taper slightly on inner side toward apex, elongate at apex, with projecting inner and wholly rounded outer angle, and highly numerous erect hairs. Metanotum with narrow median longitudinal groove, with dense rugose punctation.

Abdomen elongate. Abdominal sternites with fine punctation imparting matte appearance. Sternite V flat, markedly narrows posteriorly, notably elongate (female) or bulges somewht and with small oval impression laterally (male). Legs long and slender; hind femora thicken moderately toward apex: 1st segment of hind tarsi notably longer than all



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Figure 266. *Necydalis sachalinensis* Mats. and Tam., male.

successive ones together. Body black. Elytra dark rust, matte, sometimes darken slightly apically. Legs much lighter, reddish-yellow; mid- and hind tibiae darken. Hind tarsi light yellow. Antennae black or blackish-brown, at base along proximal half of 5th segment red or reddish-brown. Length of body 17 mm.

Material: From regions of Amur River basin. Adult insects—one male and one female (collection of Moscow State University).

Distribution: Ussuri-Primor'e region, Sakhalin. Rare.

Biology: Not studied. Flight of beetles from June through August.

IV. Subfamily Aseminae

The subfamily Aseminae comprises four tribes, of which three (Spondyliini, Asemini, and Atimini) inhabit the Holarctic and one (Michtisomini) is typical of North American fauna. For convenience of diagnosis of the tribe Spondyliini, I have not treated Spondylinae as an independent subfamily; in primitivity it is close to Parandrinae and Prioninae. However, it may be noted that the larvae and pupae of the tribes Spondyliini, Asemini, and Atimini constitute a single group with respect to some morphological features and possess common ecological characteristics.

KEY TO TRIBES

Adult Insects

- 1 (2). Antennae short, with apices not reaching base of pronotum. Foretibiae with sharp spinules on outer margin and produced, subulate at apex. 9. **Spondyliini.**
- 411 2 (1).. Antennae long, with apices reaching beyond middle of elytra or slightly shorter. Foretibiae thicken insignificantly toward apex, without spinules on outer margin, smooth, and not produced, subulate apically.
- 3 (4). Prosternal process narrow, narrows toward apex. Forecoxae usually outwardly elongate. 10. **Asemini.**
- 4 (3). Prosternal process broad, broadens toward apex. Forecoxae not outwardly elongate, hemispherical. 11. **Atimini.**

Larvae

- 1 (2). Abdominal tergite IX with spinules on posterior margin widely separated; space between them covers 0.33 width of tergite at this site. 9. **Spondyliini.**
- 2 (1). Abdominal tergite IX with spinules on posterior margin proximate; space between them covers not more than 0.20 width of tergite at this site, quite often even less.
- 3 (4). Locomotory ampullae on abdominal segments IV to VI not produced, not distinguishable from ampullae on other segments. Space between spinules on posterior margin of tergite IX covers not more than 0.16 width of tergite at this site, or spinules very close to each other [*Tetropium castaneum* (L.)]. . . 10. **Asemini.**
- 4 (3). Locomotory ampullae on abdominal segments IV to VI markedly produced, readily distinguishable from ampullae on other seg-

ments. Space between spinules on posterior margin of tergite IX covers 0.20 width of tergite at this site. 11. **Atimini.**

Pupae

- 1 (2). Pronotum laterally and on anterior margin with large spinules turned upward, falcate. 9. **Spondylini.**
- 2 (1). Pronotum laterally and on anterior margin without large spinules turned upward, falcate, only with minute spinules.
- 3 (4). Abdominal tergites in posterior half with acute spinules forming individual tufts or transversely elongate band. Urogomphi at tip of abdomen with spinules bent down and inward, directed backward. Valvifers of female not visible in dorsal view.
. 10. **Asemini.**
- 4 (3). Abdominal tergites in posterior half without spinules, only with fine setae forming transverse row. Urogomphi at tip of abdomen with spinules not bent down and inward, but parallel and directed dorsally. Valvifers of female large, visible in dorsal view. . .
. 11. **Atimini.**

9. Tribe SPONDYLINI

This tribe differs considerably from other members of Aseminae in spinules on outer margin of foretibiae, structure of antennae, and spore-bearing fossae on 3rd to 11th antennal segments in adults. However, this tribe approaches the subfamily Aseminae more closely in structure of pronotum and presence of pair of spinule-bearing urogomphi on tip of abdominal tergite IX in larvae, and also in morphological features of pupae. Spondylini is represented in the Palearctic by a single genus, and in North America by two genera (*Scaphinus* LeConte and *Spondylis* F.).

1. Genus *Spondylis* F.

Fabricius, 1775, *Syst. Entom.*, p. 195; Plavil'shchikov, 1940, *Fauna SSSR*, 22, 2, 6; Gressit, 1951, *Longicorn Beetles of China*, vol. 2, p. 32; Linsley, 1962, *Cerambycidae of North America*, 11, 19, 63.

Adult: Body thick, cylindrical. Antennae short, reach slightly beyond middle of pronotum or even do not reach it. Foretibiae broaden toward apex, crenate on outer margin, extending into long spine apically.

Larva: Body comparatively thick. Mandibles on anterior upper tapered margin triangularly notched and striate here. Labrum produced apically, pointed. Abdominal tergite IX with pair of widely separated spinules.

Pupa: Characterized by large spinules curved upward on sides and anterior margin of pronotum.

This genus consists of a single species inhabiting Eurasia, and one species (*Spondylis upiformis* Mannh.) distributed in North America.

Type species: *Attelabus buprestoides* Linnaeus, 1758.

1. ***Spondylis buprestoides* (L.)**

Linnaeus, 1758, *Syst. Nat.*, 10th ed., p. 338 (*Attelabus*); Plavil'shchikov, 1936, *Fauna SSSR*, 21, 1, 7-9.

Adult (Figure 267): Body short, bulges, almost cylindrical. Head short, with dense large punctation. Frons broad and flat, bound anteriorly by transverse semicircularly concave suture. Genae short, 0.50 width of eyes. Antennae short, with apices not reaching base of pronotum; antennal segments not longer than apical width. Mandibles long, intersected, with dense large punctation in proximal half, lustrous in distal half, with acutely produced apex.

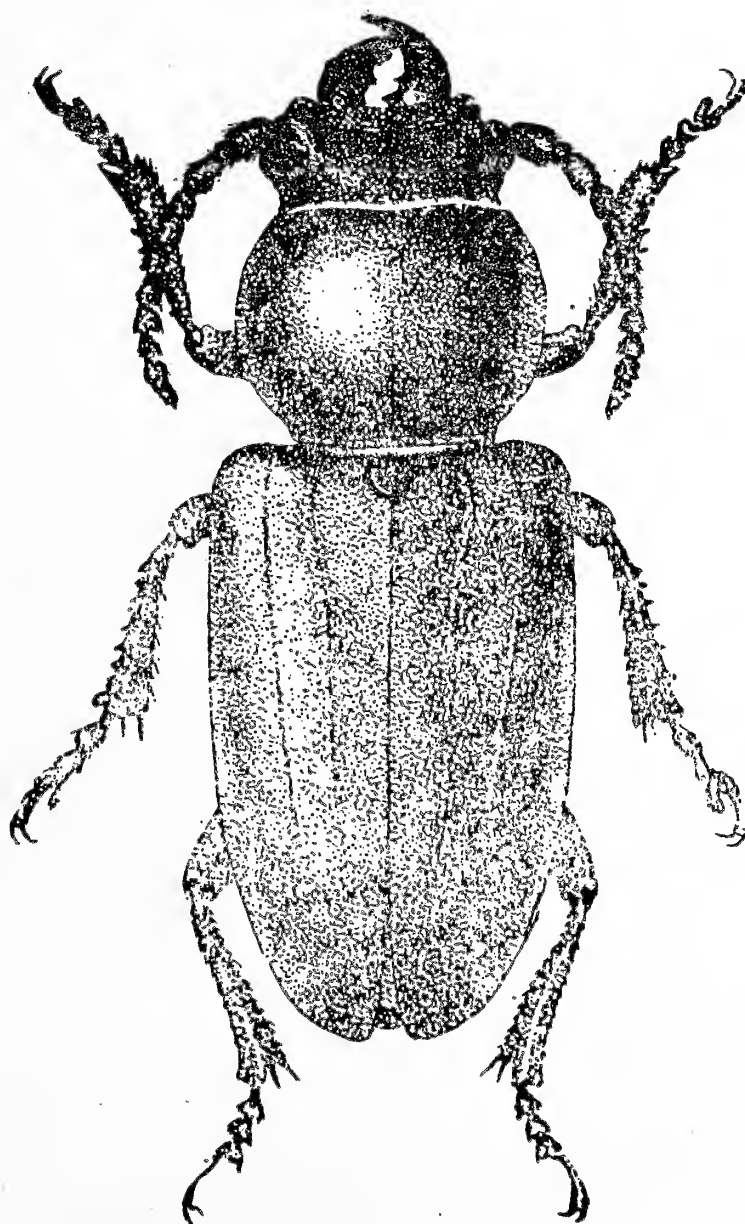


Figure 267. *Spondylis buprestoides* (L.).

Pronotum bulges, rounded laterally, narrows more posteriorly, less so anteriorly, and narrowly curved along posterior margin. Scutellum broadly rounded posteriorly, with fine punctation.

Elytra bulge markedly, with parallel sides, narrow in posterior third, jointly rounded apically; with dense rugose punctation and two parallel longitudinal ridges. Legs short; femora markedly dilated; tibiae with spinules on outer side. Body ventrally bulges markedly, with dense minute punctation and short adherent yellowish hairs. Body black, underside of thorax and abdomen sometimes brownish-rust. Length of body 13 to 22 mm.

- 413 *Egg*: Silvery-white, acquiring greenish tinge in course of time, with parallel sides, broadly rounded at poles. Chorion with distinct fine cellular sculpture; spaces between cells thin, considerably smaller than punctures per se. Length 1.9 mm, width 0.6 mm.

Larva (Figure 268): Distinguished by characteristic biapical epistoma; sclerotization of pronotum, eusternum, and locomotory ampullae; thoracic legs; and widely separated spinules on tip of abdomen. Head in posterior half rounded laterally, gently narrows anteriorly and steeply posteriorly, with dense rusty hairs on anterior margin. Epistoma flat, biapical posteriorly, with well-developed white frontal sutures laterally, dark brown median longitudinal suture, broad black transverse band

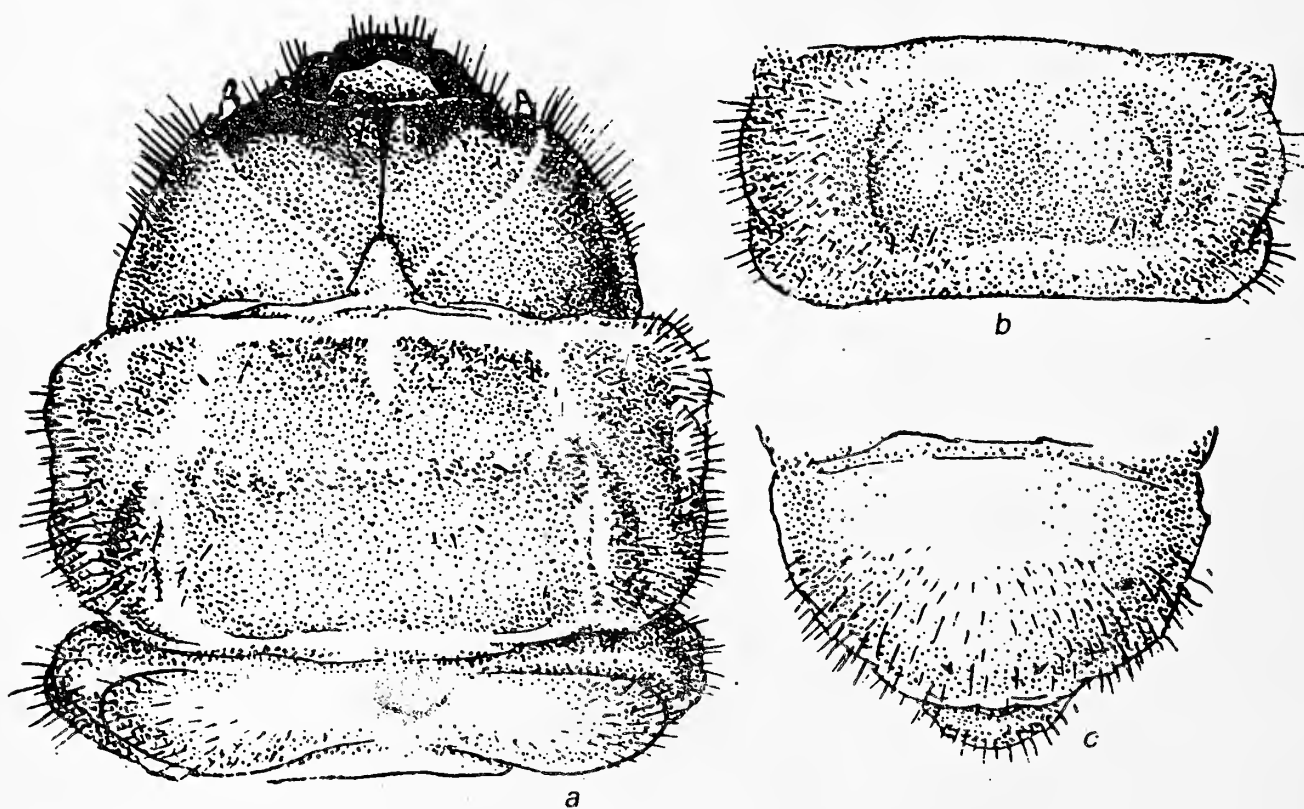


Figure 268. Larva of *Spondylis buprestoides* (L.).
a—head and pronotum; b—abdominal tergite with locomotory ampulla; c—tip of abdomen.

on anterior margin, triangular dark red spot in middle, and deep reddish-rust punctation elsewhere (along sides). Hypostoma flat, narrowly rounded anterolaterally, with narrow white band in middle, and very thin long hairs in anterior half. Clypeus white, trapezoidal, brown at base. Labrum dark red, flat, elongate, markedly narrows anteriorly, pointed apically or narrowly rounded, with dense setae almost throughout surface, with narrow longitudinal clearance only in middle. Mandibles massive, thick, taper and notched apically, longitudinally striate and matte in tapered section, produced ridgelike, with subapical additional denticle on inner cultrate edge; lower denticle elongate, rostriform, upper one obtuse.

Pronotum transverse, 1.5 times wider than long, with dense short rusty hairs laterally, very sparse hairs on disk, and broad transverse yellow band in anterior third. Pronotal shield bulges, sclerotized, with stray short setaceous hairs, bound laterally by deep longitudinal folds, sometimes emarginate on anterior margin along sides of midline, and apex produced anteriorly. Presternum with numerous short rusty hairs. Eusternum bulges, rounded on anterior margin, entirely sclerotized, with very small spinules, and entirely covered with short setaceous hairs.

414 Thoracic legs well developed, with acute acicular claws.

Abdomen comparatively thick, with dense short rusty hairs laterally. Dorsal locomotory ampullae on tergites I to VII bulge, round, with faint median longitudinal groove, slightly sclerotized, with very small spinules imparting shagreen sculpture; laterally with longitudinal slightly convex folds and some stray transverse and oblique striation. Ventral locomotory ampullae extensive, cover almost entire discoid part of sternites, shagreen, with very small spinules, long longitudinal bulging fold laterally, and transverse rugose groove in posterior half. Abdominal tergite IX short, with short hairs, and pair of widely separated dark brown spinules at apex. Body white. Head reddish-rust, pitch-black on anterior margin. Labrum rusty-red. Mandibles black. Body length of mature larvae up to 40 mm.

Pupa (Figure 269): Characterized by large spinules bent upward laterally and on anterior margin of pronotum. Body thick. Head broad and short, flat or broadly impressed between antennae, with pair of widely separated spinules posteriorly. Antennae short, slightly bent, flexed to sides.

Pronotum bulges, almost semicircular, broadly rounded or slightly obtuse anteriorly and here longitudinally striate, with rather small spinules forming tuft; laterally with four to five large spinules directed upward, three to four spinules on disk usually in corners of quadrangle, sometimes with additional minute spinules. Meso- and metanota bulge slightly, glabrous.

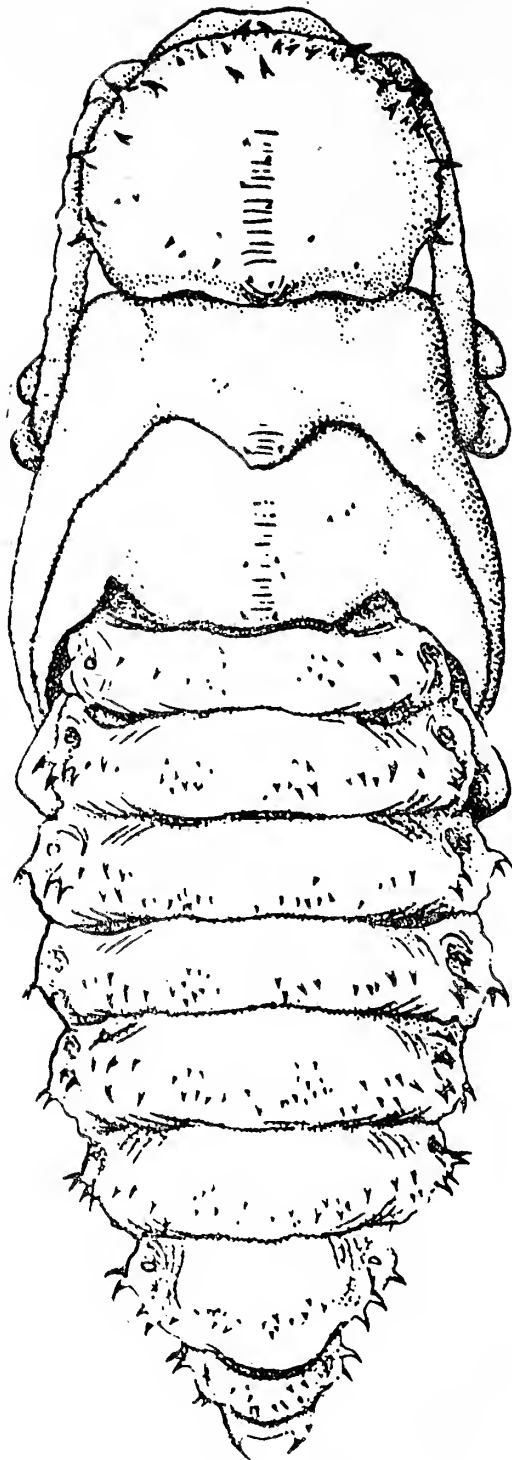


Figure 269. Pupa of *Spondylis buprestoides* (L.).

Abdomen in region of segments III to V enlarged (female) or elongate, with almost parallel sides (male). Abdominal tergites bulge, with minute spinules in posterior half on disk, and very long ones laterally directed backward. Pleural tubercles with pair of closely set spinules directed backward. Tip of abdomen with pair of widely separated urogomphi terminating in subulate spinule that is either straight or bent slightly inward. Valvifers of female slightly longitudinal, broadly rounded at apex, with pair of transverse striations apically. Length of body 23 to 24 mm, width of abdomen 8.0 mm.

Material: From Upper Ob' region. Adult insects 377, larvae 29,

pupae—10 males and 16 females, exuviae of larvae and pupae with beetles from pupal cells eight.

Distribution: From Atlantic to Pacific Ocean coasts; in Asia covers all of Siberia, Sakhalin, Japan, northern Mongolia, northern China, and Korea.

415 *Biology:* Ecologically associated with pine rising in mountains to 1,000 m above sea level. Beetles found on stumps and decaying trees. Not seen on flowers. Flight commences in June and ends in first half of September.

Beetles collected in pine forests of Ob' region. During summer 351 specimens were found, of which five (1.4%) were collected in June, 234 (66.7%)—July, 110 (31.3%)—August, and two (0.6%)—September. Beetles disappear in early September. Females colonize roots of decaying and recently dead trees and fresh stumps not affected by rot. They subsequently tunnel into soil and lay eggs on root bark singly or in batches of six each. One female can lay over 100 eggs in her life span. Egg stage continues for two to three weeks. Under laboratory conditions at $17.4 \pm 0.2^\circ\text{C}$ larvae began hatching 16 days after oviposition.

Young larvae live in bark and under bark of roots, make mainly longitudinal galleries without impressing wood, and plug them with fine bark frass. Width of these galleries 2.0 to 12.0 mm. Mature larvae bore into wood, make longitudinal meandering galleries, and plug them with fine pasty frass. Diameter of roots colonized by larvae 2.8 to 14 cm. Galleries made from apex to base. Cell usually made at end of gallery in wood in region of root base or around basal part of trunk. Larva nibbles exit from cell toward surface and plugs it with coarse fibrous frass. Length of cell 32 mm, width 15 mm.

Pupation of larvae begins in May and ends in July. Pupae maximum in second half of June and early July, and develop for two to three weeks. For example, in a laboratory experiment with three replications larvae began preparing for pupation on February 19, pupated on the 23rd, with beetles emerging on March 10. Laboratory temperature during this period was 15.4 to 21.6°C ($18.1 \pm 0.5^\circ\text{C}$). Beetles push frass away from exit, nibble round opening 5.0 to 8.0 mm in diameter on bark surface and abandon wood through it. Emergence of beetles from wood commences in June and ceases end of July or early in August.

Weight variation during metamorphosis was recorded for three insects (male). Larvae before pupation weighed 933 mg (100%), pupae developed from them 866 mg (92.8%), and adults formed from these pupae before emerging from wood 654.5 mg (70.1%). Weighings of a series of insects established that larvae weigh before pupation 191 to 720 mg (418.2 ± 37.4 mg), pupae 177 to 640 mg (372.4 ± 35.1 mg), and young beetles before emerging from wood 135 to 390 mg ($259.7 \pm$

± 22.3 mg). Life cycle (complete development from egg to adult stage) takes three years. I found this species on pine (*Pinus sylvestris*). Large numbers occur in the pine forests of the Upper Ob' region.

10. Tribe ASEMINI

Closer to the tribe Spondyliini. Adult insects of this tribe characterized by elongate flat or faintly bulging body. Antennae reach far beyond base or even beyond middle of elytra. Pronotum broad, rounded laterally (*Asemum* and others) or elongate, with almost parallel sides (*Nothorhina*).

Larvae differ from those of other tribes in presence of pair of sclerotized dark rust or almost black proximate spinules on posterior margin of abdominal tergite IX.

416 Pupae characterized by tufts of spinules on tergites and pair of urogomphi on tip of abdomen produced into long acute subulate spinule bent inward. Abdominal sternites laterally usually with tufts of spinules or hairs.

In northern Asia this tribe is represented by five genera, of which three (*Arhopalus*, *Asemum*, and *Tetropium*) are distributed in the Holarctic.

KEY TO GENERA

Adult Insects

- 1 (2). Pronotum distinctly elongate, with almost parallel sides. Eyes without emargination, oval. 1. **Nothorhina** Red.
- 2 (1). Pronotum not elongate, sometimes only slightly longer than wide, rounded laterally, without parallel sides.
- 3 (8). Eyes faintly emarginate or almost not emarginate in front.
- 4 (7). Eyes large, markedly convex, with large facets.
- 5 (6). Pronotum with dense deep distinct punctation, without granules on disk, only with small granules laterally. First segment of antennae does not reach beyond posterior margin of eyes.
. 2. **Arhopalus** Serv.
- 6 (5). Pronotum with fine fused punctation; on disk with smooth protuberant, laterally with highly numerous large spinescent granules. 3. **Megasemum** Kr.
- 7 (4). Eyes bulge slightly, finely faceted. 4. **Asemum** Eschz.
- 8 (3). Eyes emarginate in front almost up to posterior margin, divided into two (upper and lower) lobes joined by narrow smooth septum. 5. **Tetropium** Kirby.

Larvae

- 1 (2). Pronotal shield with one or two white oblique bands on inner side of anterior angles. Found in bark of viable thick-trunked pine. 1. **Nothorhina** Red.
- 2 (1). Pronotal shield without white oblique bands on inner side of anterior angles, usually with white alveolar punctation or white bands on disk. Found under bark and in wood of coniferous species.
- 3 (8). Abdominal tergite IX on posterior margin with pair of spinules set on two isolated tubercular coriaceous urogomphi. Prosternal proplesternum pubescent or glabrous.
- 4 (7). Prosternal proplesternum pubescent, with very dense short setaceous hairs.
- 5 (6). Spinules on urogomphi of abdominal tergite IX round in cross section at base, not extended transversely, aciculary pointed apically. 2. **Arhopalus** Serv.
- 6 (5). Spinules on urogomphi of abdominal tergite IX transversely extended in cross section at base, usually slightly pointed or rounded apically. 3. **Megasemum** Kr.
- 7 (4). Prosternal proplesternum glabrous, without hairs, only shagreen. 4. **Asemum** Eschz.
- 8 (3). Abdominal tergite IX on posterior margin with pair of spinules set on single common tubercular coriaceous urogomphus. Proplesternum glabrous, without hairs. 5. **Tetropium** Kirby.

Pupae

- 1 (2). Pronotum elongate, slightly rounded laterally, not transversely elongate. 1. **Nothorhina** Red.
- 2 (1). Pronotum elongate, usually transversely oval, rounded laterally.
- 417 3 (8). Abdominal tergite VII in posterior half almost entirely covered with dense spinules; if with sparse spinules, sides of abdominal sternites (especially VI to VII) with large acute spinules.
- 4 (7). Abdominal sternites without spinules laterally, usually with minute setae forming indistinct tuft.
- 5 (6). Antennae with large acute spinules on outer side. 2. **Arhopalus** Serv.
- 6 (5). Antennae smooth on outer side, without spinules. 3. **Megasemum** Kr.
- 7 (4). Abdominal sternites (especially IV to VII) laterally with large acute spinules forming dense tuft set on tubercular base. 4. **Asemum** Eschz.

- 8 (3). Abdominal tergite VII glabrous in posterior half, without spinules, or with small spinules barely visible under high magnification and forming transverse band. 5. **Tetropium** Kirby.

1. Genus *Nothorhina* Red.

Redtenbacher, 1845, *Gatt. Deutsch. Käfer*, p. 109; Plavil'shchikov, 1940, *Fauna SSSR*, 22, 2, 10; Gressitt, 1951, *Longicorn Beetles of China*, vol. 2, p. 33.

Adult: Characterized by narrow elongate body, oval nonemarginate eyes, and not very long thin antennae. Pronotum elongate, with almost parallel sides, and sharp median longitudinal, slightly punctate prominence.

Larva: Differs from larvae of other genera usually in absence of white alveolar spots on pronotal shield, and presence of one of two white bands resembling streaks on inner side of anterior angles.

Pupa: Pronotum elongate, flat on disk. Pair of fully developed or faint urogomphi present, lacking in some species.

One species of this genus is known in the fauna of northern Asia.

Type species: *Callidium punctata* Fabricius, 1798.

1. *Nothorhina punctata* (F.)

Fabricius, 1798, *Suppl. Entom. Syst.*, p. 149 (*Callidium*); Plavil'shchikov, 1940, *Fauna SSSR*, 22, 2, 11-12; Demelt, 1956, *Tierwelt. Deutsch.*, 52, 2, 52; Kojima and Hayashi, 1969, *Insect Life in Japan*, vol. 1, p. 42.

Adult (Figure 270): Easily recognized by structure of pronotum. Body narrow, elongate. Head short, uniformly rounded on occiput, with dense punctures. Eyes oval, nonemarginate. Antennae thin, with apices reaching beyond middle of elytra (male) or short of this level (female).

Pronotum elongate, longitudinally bulges more in middle and here with sparse, rather small punctation and laterally dense, very large punctation; further laterally with coarse granular punctation.

Elytra bulge slightly, rounded at apex; with fine punctation, tender hairs, and faint longitudinal ridges. Legs short; femora dilated toward apex, 1st segment of hind tarsi slightly longer than two successive together. Body dark brown, with rusty tinge or partly pitch-brown. Pronotum sometimes with projecting rusty spot on disk.

Egg: White, lustrous, elongate, narrows toward both ends, and narrowly rounded at poles. Length 1.1 mm, width 0.35 mm.

Larva (Figure 271): Characterized by sclerotized pronotal shield, eusternum, and locomotory ampullae, and quite often by absence of paired urogomphal spinules at tip of abdominal tergite IX. Body

moderately elongate, not flat. Half or less of head retracted into protho-
418 rax. Epistoma biapical posteriorly, with dense tuft of long setaceous hairs
in anterior third along sides, well-developed cinnamon-brown median
longitudinal suture, and bound laterally by perceptible frontal sutures.
Hypostoma reddish-rust, divided in middle by white gula, rounded later-
ally, narrows more anteriorly; with setaceous comparatively long hairs
concentrated more on inner half around gula. Dense setaceous hairs in
anterior half of sides of temporo-parietal lobes. Antennae short, with
two segments. Clypeus large, whitish, lustrous, trapezoidal. Mandibles
slightly elongate, gently notched apically, with produced cultrate edge.
Labrum bulges, broadly rounded anteriorly, white in anterior half, with
long setae laterally, shortened rusty-brown setae medially, and glabrous

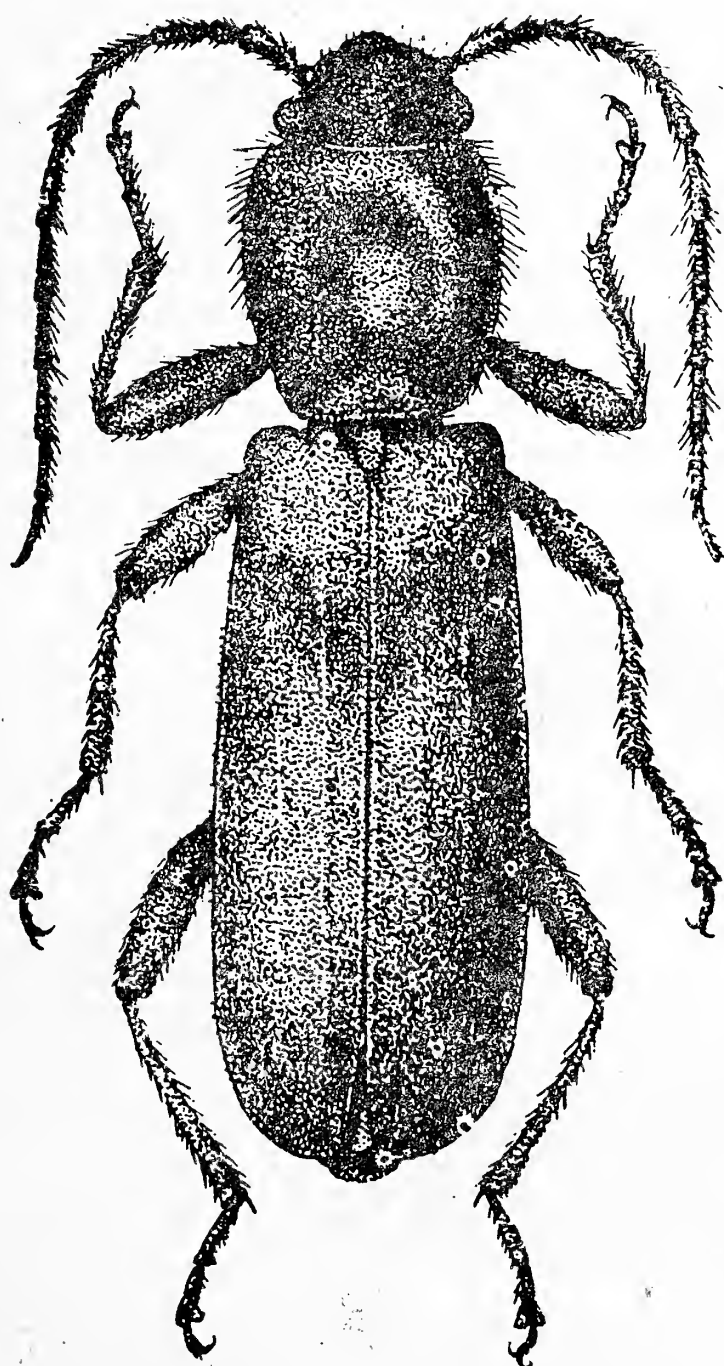


Figure 270. *Nothorhina punctata* (F.).

in posterior half. Maxillae and labium with long thick setae forming one (cardo, stipes, and submentum) or two (mentum) groups at base of each segment. Inner lobes of maxillae with long dense setae.

Pronotum transverse, 2.0 times wider than long, rounded laterally. Anterior half of pronotal disk lustrous, often with faint transverse striation, and fine light-colored hairs on anterior margin and sides. Pronotal shield bound laterally by deep longitudinal grooves, sclerotized or rusty toned, with very fine dense spinules, broadly emarginate on anterior margin, with produced anterior angles and inward to them with smooth oblique white streaks, sometimes divided into two short ones. Alar lobes glabrous, sclerotized. Prothoracic presternum with even rusty hairs, eusternum entirely sclerotized with rusty tone, and usually with sparse setaceous hairs in anterior half. Thoracic legs fully developed, with fine short claws.

Abdomen laterally with dense short light-colored hairs. Locomotory ampullae developed on abdominal segments I to VII, slightly sclerotized, shagreen, divided by two transverse grooves. Abdominal tergite IX transverse, broadly rounded posteriorly, glabrous on disk, with sparse light-colored hairs laterally and on posterior margin, and pair of proximate sclerotized urogomphi at tip usually bent ventrad toward each other. Distance between urogomphi slightly more than thin basal width. They are sometimes well developed, sometimes poorly, or totally lacking. Specimens found in which only one (right or left) urogomphus present. Anal lobes with dense short hairs. Head reddish-rust, sides of

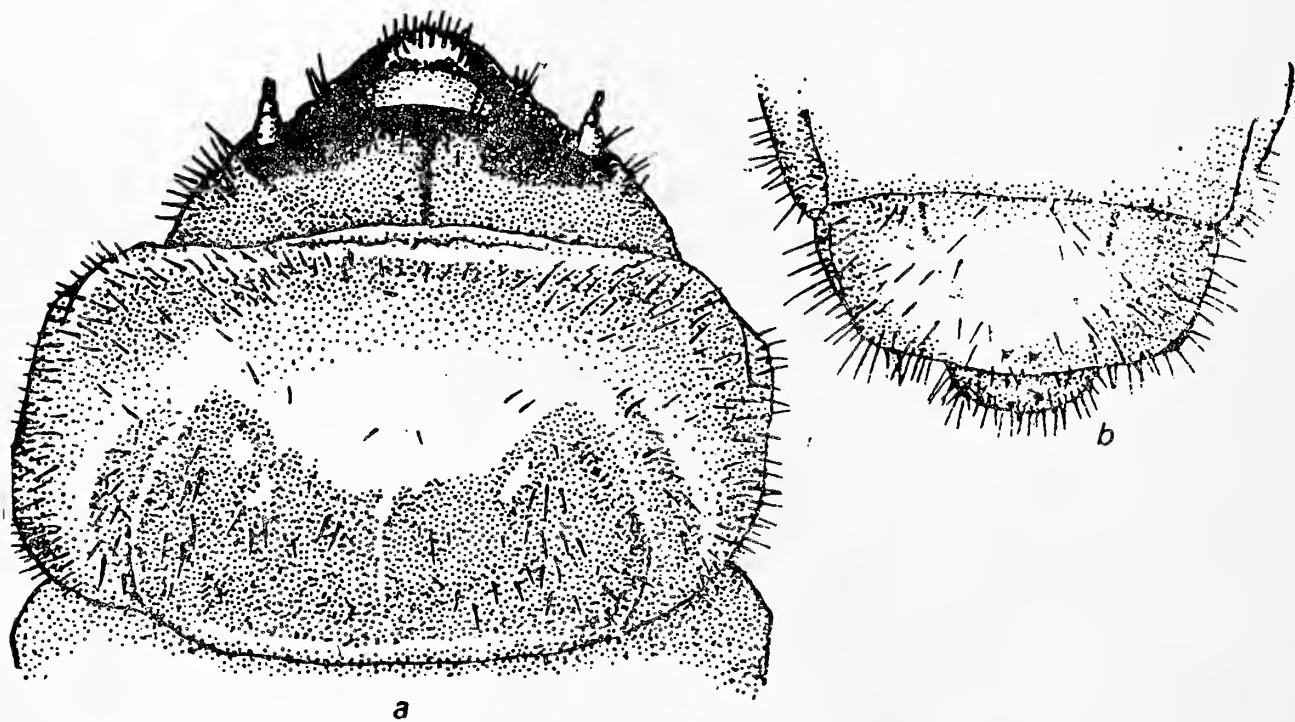
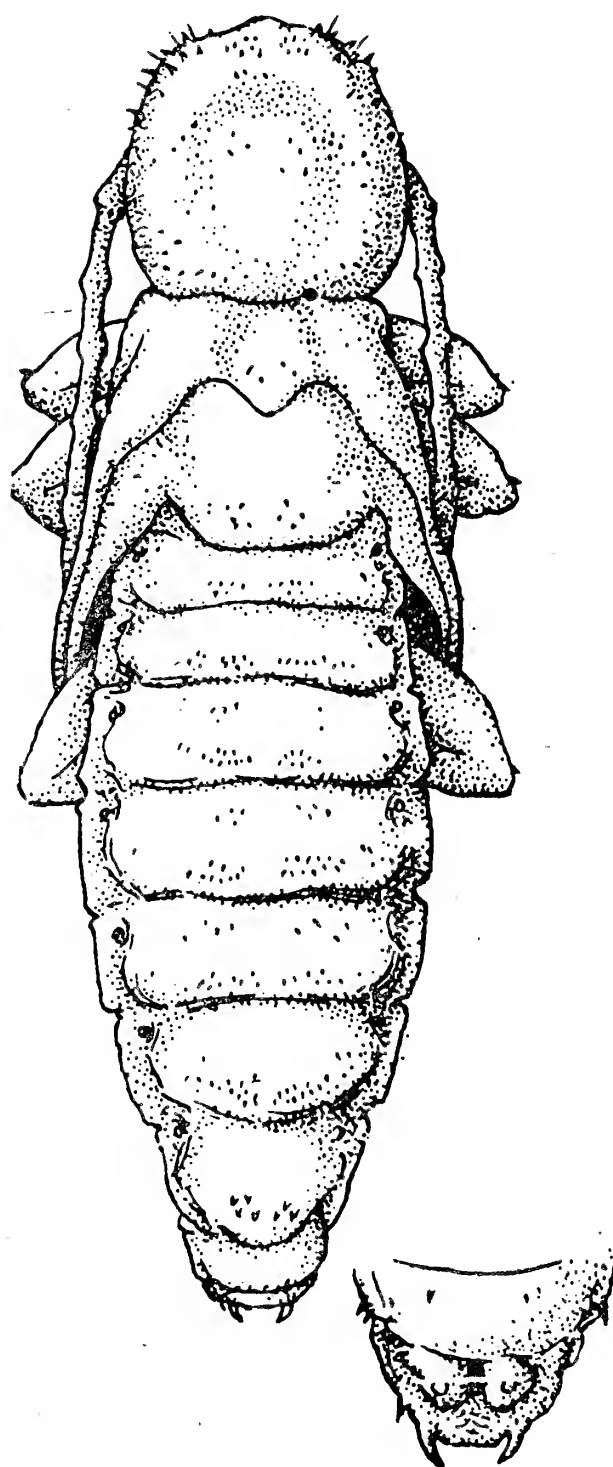


Figure 271. Larva of *Nothorhina punctata* (F.).
a—head and pronotum; b—abdominal tergite IX.

temporo-parietal lobes whitish, anterior margin of epistoma and mandibles dark brown, almost black. Body length of mature larvae 14 to 16 mm, width of cephalic capsule up to 2.1 mm.

Pupa (Figure 272): Body elongate. Head moderately bent under, flat between antennae and upper lobes of eyes, bulges angularly, glabrous, without setae, smooth on occiput. Antennae short, flexed to sides, slightly curved, with apices adjoining elytra.

Pronotum elongate, with almost parallel sides, rounded angles, flat on disk, and with acute, slightly sclerotized spinules on anterior margin set on protuberant coriaceous base forming transverse band. Meso- and metanota bulge, lustrous, with indistinct spinules.



Abdomen elongate, slightly narrows anteriorly, markedly posteriorly. Abdominal tergites bulge moderately, with acute indistinct spinules in posterior half forming tuft on each side of longitudinal groove. Abdominal tergite VII rounded posteriorly, with minute spinules in posterior half at posterior margin. Tip of abdomen (dorsal view) with pair of small urogomphi bent ventrad toward each other and terminating in slightly sclerotized spinule. In some specimens urogomphi barely developed or altogether imperceptible. Valvifers of female hemispherical, contiguous, with tubercular apical formation. Length of body 10 to 13 mm, width of abdomen 3.0 to 3.5 mm.

Material: Collected around Kokchetav. Adult insects raised from larvae two, pupae—one male and three females, larvae 13, larval exuviae with beetles two.

Distribution: West and eastern Europe, southern regions of western Siberia, and Japan. Sporadic everywhere.

Biology: Inhabits pine plantations. Flight of beetles from second half of June to end of July. Beetles creep along bark of thick trunks, often hiding in bark crevices, fly from one tree to another, and so forth. I found larvae and pupae of this species in thick bark region of pine trunks 40 to 80 cm in diameter at chest height. Larvae live in bark layer of viable pines, make galleries in this layer from bottom upward, and plug them with bark frass. Length of larval gallery up to 11.5 cm or more, width 5.0 to 8.0 mm. Bast not damaged by larvae and hence galleries in bark not filled with insect excreta.

Mature larva after second hibernation makes cell at end of gallery oblique to trunk surface and pupates in it with its head upward. Length of cell 15 to 19 mm, width 5.0 to 8.0 mm. Bark layer between cell and trunk surface 1.0 to 2.0 mm. Pupation of larvae commences in first 10 days of June and ends in second half of this month. Pupal stage continues for about two weeks. Emergence of beetles from pupae commences around June 20 and ends early July. I found the first beetle in bark on June 17. Developed beetles nibble oval opening on bark surface and abandon pupal cell through it.

Weight of larvae before pupation 43.5 to 68.0 mg, pupae 38.4 to 59.8 mg, and adult insects 27.0 to 49.1 mg. In one instance a larva before pupation weighed 53.8 mg, pupa developed from it (female) 48.0 mg, and adult emerging on fourth day 34.7 mg; another larva weighed 50.1 mg, pupa (female) 47.9 mg, i.e., weight of insects during pupal formation fell by 10.8 and 4.4% and in adult formation by 27.7%. In June II- and III-instar larvae, pupae, and young beetles occur simultaneously on the same trees. This suggests that the same tree is colonized repeatedly (possibly many times). Life cycle of this insect completed in two years.

2. Genus *Arhopalus* Serv.

Serville, 1834, *Ann. Soc. Entom. France*, vol. 3, p. 77; Mulsant, 1839, *Coleopt. France, Longicorn*, p. 63 (*Criocephalus*); Plavil'shchikov, 1940, *Fauna SSSR*, 22, 2, 12–13 (*Criocephalus*); Linsley, 1962, *Cerambycidae of North America*, 2, 19, 68–69; Gressit, 1951, *Longicorn Beetles of China*, vol. 2, pp. 33–34; Kojima and Hayashi, 1969, *Insect Life in Japan*, vol. 1, p. 43; Mamaev and Danilevskii, 1975, *Lichinki zhukov-drovosekov*, pp. 157–158 (*Criocephalus*).

Adult: Differs from adult insects of other genera of Asemini in short head, antennae shifted almost right to base of mandibles, markedly elongate and slightly convex elytra, and thick 1st antennal segment.

421 *Larva*: Characterized by sclerotized pronotal shield with dense minute spinules, rusty, with numerous round nonsclerotized white punctation. Eusternum and locomotory ampullae on abdominal segments I to VII sclerotized. Posterior margin of abdominal tergite IX with pair of proximate spinose urogomphi; spinules on urogomphi thin and acute (in larvae of the genus *Megasemum* they are short, transversely elongate, appear flattened).

Pupa: Pronotum transversely oval, covered (especially along margin) with thin piliform setae and often additionally by spinules bent down laterally. Tip of abdomen with long urogomphi bent down and inward.

The genus *Arhopalus* inhabits the Holarctic. Three species are known in Europe, two in northern Asia, nine in southern Asia (of which *Arhopalus coreanus* Sharp. occurs in South Korea), two in Japan [*A. rusticus* (L.) and *A. tobirensis* Hay.], and four in North America including *Arhopalus rusticus* (L.), recorded there as four geographic races.

Type species: *Cerambyx rusticus* Linnaeus, 1758.

KEY TO SPECIES

Adult Insects

- 1 (2). Eyes covered with short setae. Antennae markedly proximate to base of mandibles; space between antennal socket and anterior margin of gena much smaller than width of articulate antennal tubercle. 1. *A. rusticus* (L.).
- 2 (1). Eyes glabrous, without setae. Antennae notably removed from base of mandibles; space between antennal socket and anterior margin of gena not less than width of articulate antennal tubercle. 2. *A. tristis* (F.).

Larvae

- 1 (2). Anterior margin of head laterally behind antennal bases entirely covered with dense hairs, without white glabrous band. Legs comparatively slender; apex of trochanter on inner side with collar of closely set setae. 1. *A. rusticus* (L.).
- 2 (1). Anterior margin of head laterally behind antennal bases with elongate glabrous white band extending parallel to frontal suture. Legs comparatively thick, conical; apex of trochanter on inner side glabrous, without setae. 2. *A. tristis* (F.).

1. *Arhopalus rusticus* (L.)

Linnaeus, 1758, *Syst. Nat.*, 10th ed., p. 395 (*Cerambyx*); Plavil'shchikov, 1940, *Fauna SSSR*, 22, 2, 13-16 (*Criocephalus*); Linsley, 1962, *Cerambycidae of North America*, 11, 19, 69-75; Duffy, 1958, *Monograph. Beetles*, pp. 77-78.

Adult (Figure 273): Body elongate. Head short, with deep median longitudinal suture, dense punctation, and sides of frons marginally raised at antennal bases. Antennae thin markedly from base to apex, with coarse punctation, and dense short setaceous hairs; antennal apices reach far beyond middle of elytra (male) or barely reach this level (female). Eyes bulge moderately, with large facets, widely but insignificantly emarginate, with numerous short setae.

Pronotum wider than long, with dense deep punctation and fine hairs; rounded laterally, sometimes narrows more toward base, bulges slightly on disk, with more or less deep longitudinal dent laterally; additionally, in some specimens, small transverse impression present at base and on anterior margin. Scutellum broadly rounded posteriorly; sometimes longitudinally impressed in middle, with fine punctation and minute adherent hairs.

- 422 Elytra bulge slightly, markedly elongate, with parallel sides, rounded together posteriorly, with produced or steeply rounded inner angle, more or less developed longitudinal ridges on disk, dense double punctation and fine brownish hairs. Femora thicken moderately; hind tibiae longer than tarsi. Third segment of hind tarsi bifurcate almost up to base. Abdominal sternite V longitudinally elongate, narrowly rounded posteriorly (female) or transverse, considerably wider than long, and broadly rounded apically (male). Body dark brown with rusty or chestnut tone. Length of body 9.0 to 27.0 mm.

Egg: White, elongate, broadly rounded at one pole and narrowly at the other. Chorion smooth, lustrous, without cellular sculpture. Length 1.9 mm, width 0.5 mm.

Larva (Figures 274 and 276b): Very similar to larva of *Megasemum*

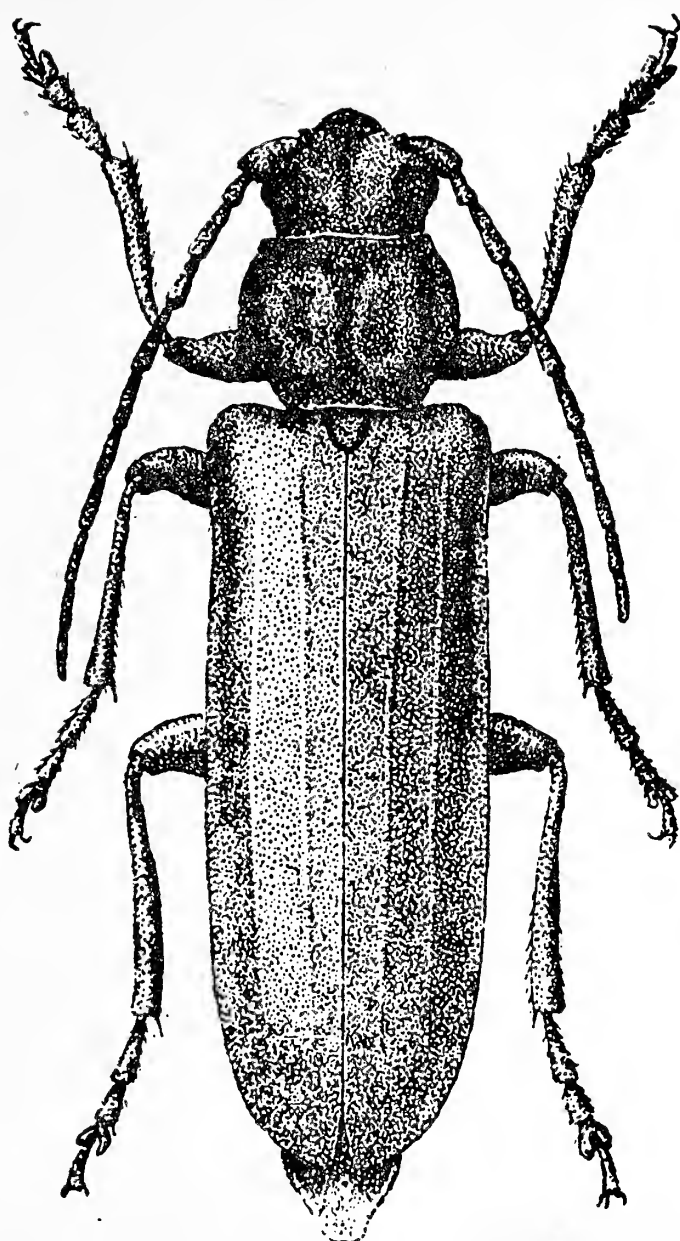


Figure 273. *Arhopalus rusticus* (L.).

quadricostulatum Kr. Differs in structure of spines at apex of tergite IX, absence of distinct sclerotized rings around bases of hairs on sides of head, and other features. Head slightly narrows anteriorly, with dense hairs anterolaterally devoid of sclerotized brown ringlet at base. Epistoma broad, flat, dark rust, black on anterior margin, biapical posteriorly in form of two rectangular projections, and with numerous long and short hairs almost throughout entire surface. Frontal sutures white, straight or slightly bent. Longitudinal suture continuous, not interrupted medially. Hypostoma bulges slightly, dark rust, with white gula in middle, numerous setaceous hairs almost throughout entire surface, and rounded or slightly narrows anterolaterally. Clypeus white, lustrous, narrows anteriorly, 2.0 times longer than width at anterior margin. Labrum elongate, dark reddish-rust, pointed apically and here whitish, with dense small and long setae posterolaterally. Mandibles massive,

roundly notched upward around cultrate edge, and here matte and finely striate; with two long carinae on inner surface extending toward apex of lower denticle, and single short carina extending toward intermediate denticle.

Pronotum narrowly rounded anteriorly and posteriorly, with dense rusty hairs laterally, white border set with fine hairs on anterior margin, behind which occurs broad rusty transverse band intercepted by longitudinal clearances in middle and at sides, and brownish, usually transversely elongate specks in anterior half. Pronotal shield rusty, with dense minute spinules, and dense round or elongate white nonsclerotized punctures; spaces between them equal to or even smaller than
423 punctures per se; and bound laterally by deep longitudinal fold. Presternum mottled brown, with dense rusty setaceous hairs, and sclerotized border on inner margin adjoining eusternum. Propresternum white, entirely covered with fine close hairs. Eusternum bulges, sclerotized, with abundant round white punctation, and minute sparse setaceous hairs emerging from white punctation toward base, highly numerous large ones at apex.

Abdomen laterally with not very close rusty hairs. Locomotory ampullae bulge moderately, sclerotized, entirely covered with minute rusty spinules, and laterally with more or less distinct longitudinal convex folds. Abdominal tergite IX along posterior margin with pair of proximate tubercular urogomphi, each with sharp elongate apical spinule

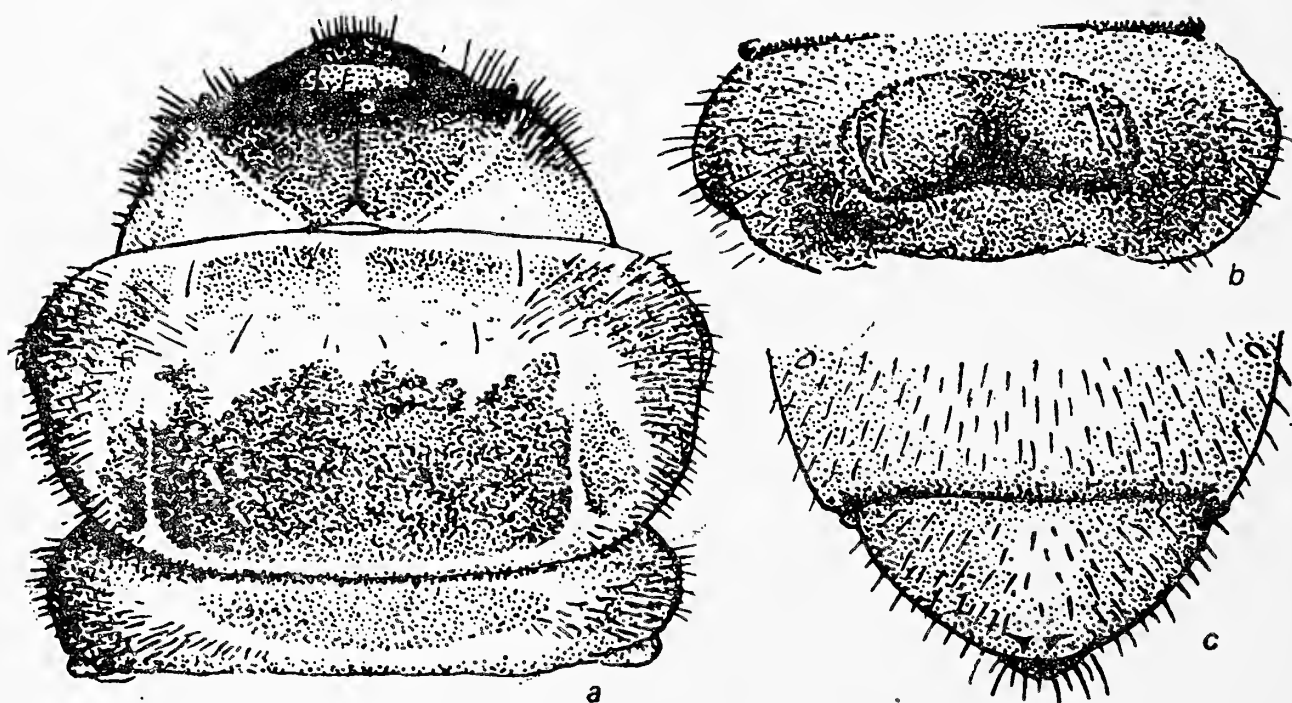
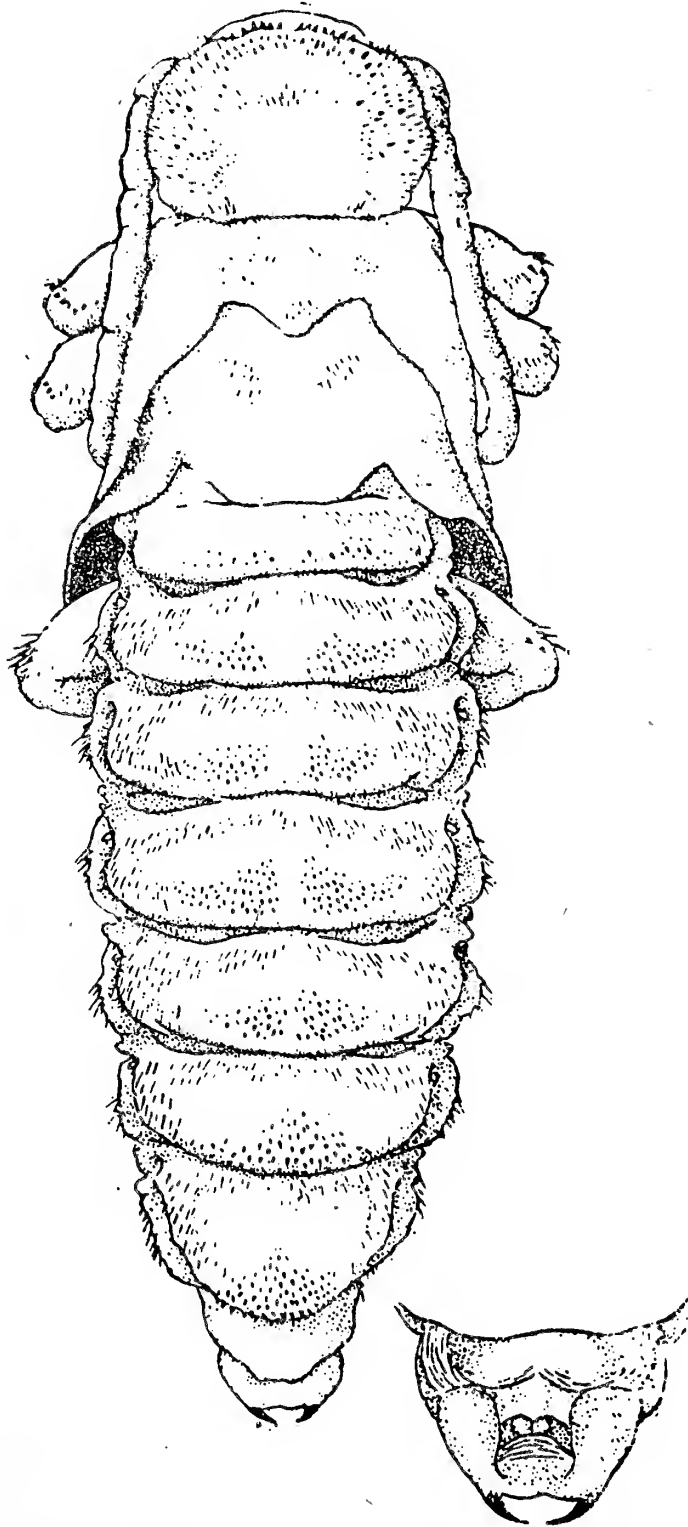


Figure 274. Larva of *Arhopalus rusticus* (L.).
a—head and pronotum; b—abdominal tergite
with locomotory ampulla; c—tip of abdomen.

bent ventrad and inward. Body length of mature larvae 30 to 37 mm, width of head 5.0 to 6.0 mm.

Pupa (Figure 275): Readily distinguished from pupae of other species by antennae markedly proximate to base of mandibles and dense spinous cover of abdominal tergites. Head very short, flat between antennae. Labrum triangular, pointed apically. Antennae arcuate (female) or almost annular (male); 1st segment with acute subulate spinules.

Pronotum transversely oval, slightly convex or flattened on disk,



with minute transverse foldlike striation, thin setae on sides and anterior margin set on protuberant coriaceous base, and quite often (especially in male) with acute spinules bent toward sides. Meso- and metanota with thin piliform setae forming tuft on each side.

Abdomen insignificantly narrows anteriorly and gradually posteriorly. Abdominal tergites anterior to middle with transverse dent, dense minute piliform setae in front of this dent and along sides, and numerous short brownish spinules behind forming broad transverse field. Tergite VIII smooth and glabrous or with stray piliform setae. Tip of abdomen (ventral view) obtuse, bound laterally by glabrous coriaceous carina that terminates in long spinescent urogomphi bent down and toward each other. Distance between apices of urogomphi less than length of urogomphus. Valvifers of female large, hemispherical, sometimes more produced apically, bent down and toward each other. Length of body 14 to 28 mm.

Material: From eastern Ural region, Upper Ob' region, Altai, Tuva, Baltic region, and Ussuri-Primor'e region. Adult insects 533, larvae 444, pupae—17 males and 13 females.

Distribution: Belongs to the group of Holarctic species. Distributed in the Old and New World, extending in Eurasia from Atlantic to Pacific Ocean coasts, including all of Europe, the Caucasus, the Urals, western and eastern Siberia, Primor'e, and Sakhalin; Japan, Korea, northern China, and northern Mongolia.

Biology: Lives mainly in pine forests, highly numerous in temperate latitudes. Extends high in mountains; I found it in Altai at a height of 2,000 m above sea level. Flight of beetles commences in June and ends in August, but some insects sighted in September and sometimes even in early October. Of the 345 beetles collected over several years in Ob' and Kuludinsk pine forest belts (western Siberia), 108 (31.3%) were found in June, 190 (55.1%)—July, 40 (11.6%)—August, four (1.1%)—September, and three (0.9%)—October. Beetles are more active in warm twilight hours. They creep on trunks in basal zone of decaying and dead trees, stumps, and exposed roots. They often fly to light at night. Female lays eggs in bark crevices singly or rarely in batches of three to four. Fecundity of females indicated by the following example. Ovaries of one female raised in the laboratory contained 171 eggs, of another found in nature 159 mature eggs. Embryonic development continues for two or three weeks. In one of the laboratory experiments with 135 eggs, larvae hatched 13 to 18 days after oviposition; mean duration of egg stage was thus 14.7 ± 0.2 days. Atmospheric temperature during this period was 16.6 to 21.6°C, with a mean daily temperature of 18.6 ± 0.2 °C.

Larvae initially live under bark in region of thick roots or in basal

zone of trunk; they later bore into wood, make longitudinal galleries, and plug them with frass. Mature larva makes cell at end of gallery along trunk, nibbles an exit toward surface, plugs it with coarse frass, and pupates with head upward. Length of cell 3.0 to 8.0 cm, width up to 1.0 cm, and length of transverse opening (exit) plugged with frass 3.0 to 5.0 cm. In stumps larva often makes an exit at end and plugs it compactly with fibrous frass.

Pupation commences in May and extends up to mid-July. Pupae maximum at end of June and in early July. Pupae develop in about three to four weeks. In the coastal Lake Telets zone beetles emerged on July 27 from pupae that had formed on June 30. In Salair a pupa was seen on May 30 and the beetle emerged June 29. Similar observations have been recorded in other cases. Developed beetles break plug sealing exit, make oval opening (8.0 mm \times 6.0 mm) on surface, rarely smaller, and abandon wood through it. Beetles emerge from cells with developed gonads and are capable of reproducing without supplementary feeding. In the laboratory one female mated the same day she emerged from wood and oviposited without supplementary feeding. Weight indexes of insects in different developmental stages vary considerably. Larvae before pupation weighed 137 to 750 mg (476 ± 48.2 mg), pupae 125.5 to 670.0 mg (401.6 ± 42.3 mg), and beetles before emerging from wood 105 to 490 mg (284.2 ± 29.1 mg). Some individuals lose 35 to 44% of their weight during metamorphosis, with weight loss maximum in dry wood.

Arhopalus rusticus (L.) colonizes mainly pine, more rarely other coniferous trees. We recovered 146 beetles from wood specimens colonized by this species in nature, of which 133 were from pine (*Pinus sylvestris*), seven from Siberian stone pine (*Pinus sibirica*), four from Siberian fir (*Abies sibirica*), and two spruce (*Picea obovata*). *Spondylis buprestoides* (L.), *Asemum striatum* (L.), *Anoplodera rubra* (L.), *Tetropium castaneum* (L.), and others are found together with this species.

2. *Arhopalus tristis* (F.)

Fabricius, 1787, *Mant. Ins.*, vol. 1, p. 154 (*Callidium*); Plavil'shchikov, 1940, *Fauna SSSR*, 22, 2, 16–17 (*Criocephalus*); Gressitt, 1951, *Longicorn Beetles of China*, vol. 2, pp. 35–36.

Adult: Very similar to *Arhopalus rusticus* (L.). Differs in absence of setae on eyes, incomplete bifurcation of 3rd segment of hind tarsi, and other features. Body elongate. Head short. Antennal sockets separated from anterior margin of gena by space equal to width of articulate antennal tubercle [in *A. rusticus* (L.) space between anterior margin of gena and antennal socket much less than width of articulate antennal tubercle]. Eyes bulge markedly, with large facets, insignificantly emarginate, glabrous, without setae.

Pronotum uniformly rounded laterally, bulges, with notable median longitudinal groove and broad dent lateral to it; more or less perceptible transverse impression in anterior and posterior third makes pronotum look as though it has four tubercles on disk. Elytra elongate, slightly narrow posteriorly, rounded apically, with rounded inner angle, bulge uniformly, with two longitudinal ridges, fine close punctation, and minute brownish hairs. Third segment of hind tarsi narrow, bifurcate only up to midlength. Body and elytra black, metathorax more often reddish. Sometimes body blackish-brown, metathorax more reddish. Elytra rusty, scutellum almost red. Length of body 12 to 27 mm.

Egg: White, gradually narrows toward one end, rounded at poles. Chorion smooth, transparent, hyaline. Length 1.8 mm, width 0.5 mm.

426 *Larva*: Very similar to larva of *Arhopalus rusticus* (L.). Well distinguished from it by whitish, glabrous, slightly impressed facet (Figure 276, a) extending parallel to frontal suture behind antennal bases on anterior margin of head, and thick thoracic legs devoid of setae on inner side. Head markedly narrows anteriorly, broadly rounded in posterior half, with dense long hairs laterally in anterior half, and elongate, white, glabrous, slightly impressed facet behind antennal bases extending along frontal suture. Row of long setaceous hairs between this facet and frontal suture. Epistoma flat posteriorly, slightly bulges transversely in anterior half, with uneven setaceous hairs.

Pronotum transverse, with dense rusty hairs laterally, stray setaceous hairs on disk, and white glabrous border on anterior margin. Pronotal shield sclerotized, rusty, with numerous white punctures fusing here and there into longitudinal or oblique bands. Presternum with not very

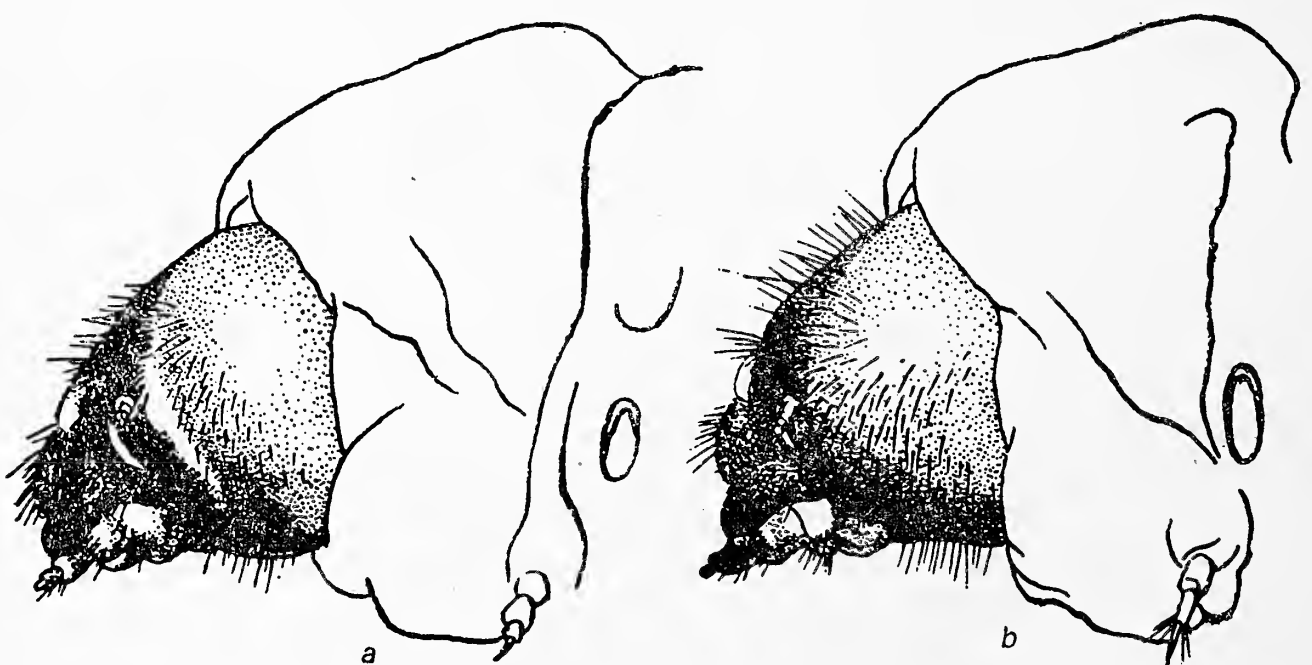


Figure 276. Lateral view of head of larvae.

a—*Arhopalus tristis* (F.); b—*Arhopalus rusticus* (L.).

dense (almost sparse) rusty setaceous hairs. Propresternum white, hyaline, with sparse hairs posteriorly, glabrous or with stray short hairs in anterior half (at base). Eusternum densely sclerotized, with white round punctation set with hairs. Legs comparatively thick, conical; trochanter glabrous on inner side, without setae [in *A. rusticus* (L.) legs slender, elongate and inner side of trochanter with collar of dense apical setae].

Abdomen laterally with rusty, not very dense hairs. Locomotory ampullae densely sclerotized, bulge, divided by common median longitudinal groove. Abdominal tergite IX on posterior margin with two tubercular proximate urogomphi terminating in acute spinule slightly turned inward. Body length of mature larvae 38 mm, width of head 7.0 mm.

Pupa: Not known.

Material: From Ob' region and Kulunda. Adult insects 59, larvae two.

Distribution: Europe, northern Africa, the Caucasus, Syria, Siberia, and northern China.

427 *Biology*: Inhabits mature pine vegetation. Flight of beetles seen from middle 10 days of June to end of August. For example, of 47 beetles collected in pine forest belts of Kulunda, six (12.8%) were found in June, 18 (38.3%)—July, and 23 (48.9%)—August. Beetles lead a cryptic mode of life. They are found in basal zone of trunks of decaying thick-trunked trees and on stumps. Female lays eggs in bark crevices on exposed roots. Ovaries of one dead female after oviposition contained 41 eggs. However, average fecundity of female markedly high. From eggs laid by beetles under laboratory conditions on July 10, larvae hatched on July 20 and 21. We kept 76 eggs under observation at 24 to 27°C. Larvae live under bark and in wood, make longitudinal galleries, and plug them with frass. In ecological characteristics this species is close to *Arhopalus rusticus* (L.), with which it frequently colonizes the same trees and occupies similar niches.

3. Genus *Megasemum* Kr.

Kraatz, 1879, *Deutsch. Entom. Z.*, vol. 23, p. 97; Plavil'shchikov, 1940, *Fauna SSSR*, 22, 2, 18; Gressit, 1951, *Longicorn Beetles of China*, vol. 2, p. 37 (*Arhopalus*).

Adult: Distinguished from beetle of the closely related genus *Arhopalus* by thicker, more bulging body, presence of tubercles on pronotum, and dense setae on under side of hind tarsi forming tomentose platelets.

Larva: Epistoma laterally around frontal sutures with small whitish

spot; prosternal propresternum with fine comparatively dense hairs; eusternum sclerotized, with very dense white round, often pubescent punctation.

Pupa: Pronotum laterally and on anterior margin with minute setae set on protuberant coriaceous base. Abdominal tergites in posterior half with short obtuse spinules or rounded, rarely pointed, spinules forming uneven transverse band on posterior margin.

The genus *Megasemum* is represented by a single species in eastern region of Asia.

Type species: *Megasemum quadricostulatum* Kraatz, 1879.

1. *Megasemum quadricostulatum* Kr.

Kraatz, 1879, *Deutsch. Entom. Z.*, p. 98; Plavil'shchikov, 1940, *Fauna SSSR*, 22, 2, 18-20; Gressitt, 1951, *Longicorn Beetles of China*, vol. 2, pp. 37-38 (*Arhopalus*); Kojima and Hayashi, 1969, *Insect Life in Japan*, vol. 1, p. 44.

Adult (Figure 277): Body elongate, with parallel sides, cylindrical. Head short, with deep median longitudinal suture, produced frontal tubercles at antennal bases, and coarse dense deep punctation; spaces between punctures lustrous. Eyes elongate, with large facets, gently emarginate. Antennae in male long, with spices reaching beyond 0.75 length of elytra, comparatively short in female, reaching or short of reaching 0.50 length of elytra. First antennal segment thick, nodose, width 0.66 length (male) or elongate with width 0.50 length (female); 3rd segment long, equal to 1st and 2nd segments together (male) or notably shorter (female).

Pronotum bulges markedly, rounded laterally, with broad dent on disk, sometimes with smooth median longitudinal band, with fine close punctation, transverse uneven, sometimes pubescent lustrous tubercles, distinctly edged basally, barely apically. Scutellum flat, with dense punctation, with or without smooth longitudinal groove and broadly rounded posteriorly.

Elytra elongate, bulge, almost semicylindrical, gently rounded together at apex, with steeply rounded inner angles, and two longitudinal
428 ridges on disk; with very dense minute rugose punctation, fine transverse striation, and very fine adherent brownish hairs. Hind tibiae markedly longer than tarsi. First segment of hind tarsi shorter than two successive ones together. Body black or pitch-brown with reddish-rust tone. Male usually lighter in color, female very dark. Length of body 15 to 35 mm.

Egg: Elongate, with parallel sides, rounded at ends. Chorion smooth, without noticeable sculpture. Length 2.0 mm, width 0.5 mm.

Larva (Figure 278): Easily recognized by light-colored spot on sides

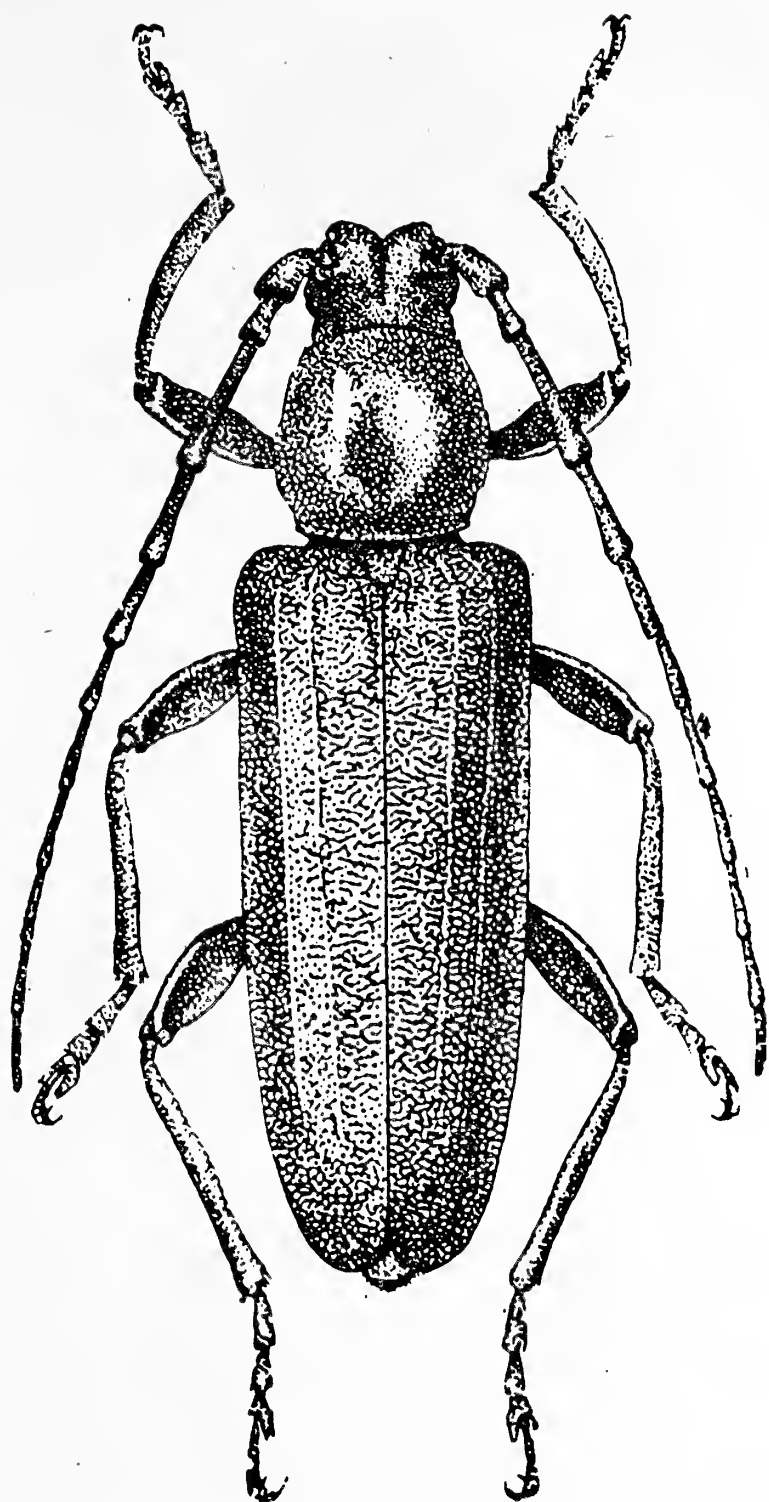
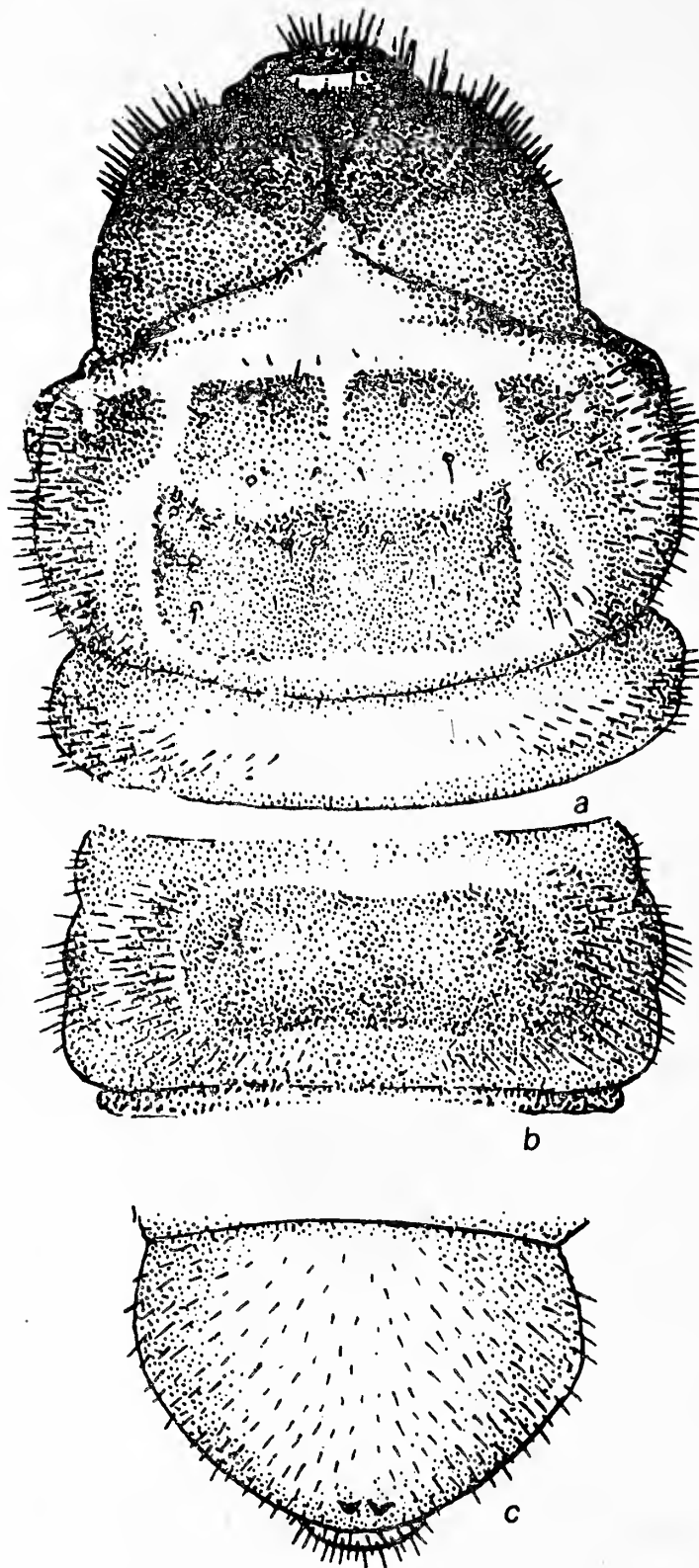


Figure 277. *Megasemum quadricostulatum* Kr.

of epistoma, or if such spots lacking, recognized by pubescent prosternal propretsternum and other features. Head narrowly rounded anteriorly, with dense long rusty hairs laterally in anterior half. Epistoma brownish-red, black on anterior margin, usually with whitish spot on sides near frontal sutures in middle (frontal sutures here sometimes slightly convex), and light-colored spot at apex. Median suture entirely dark brown. Frontal sutures white, distinct. Hypostoma rounded laterally, narrowly rounded toward apex and base, dark red, and bulges moderately; with narrow median longitudinal white band and highly numerous setaceous



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Figure 278. Larva of *Megasemum quadricostulatum* Kr.

a—head and pronotum; b—abdominal tergite with locomotory ampulla; c—tip of abdomen.

hairs. Clypeus white, short, length about 0.33 width. Labrum dark brown, produced apically, pointed, and whitish here; with minute setae, but on disk and sides with very long setae, smooth only at base. Mandibles with elongate lower denticle, roundly or triangularly notched upward at cultrate edge and obliquely striate here; with two long carinae

on inner surface extending toward apex of lower denticle, and one short carina extending toward subapical (intermediate) denticle; with finely striate elongate facet located between intermediate denticle and base.

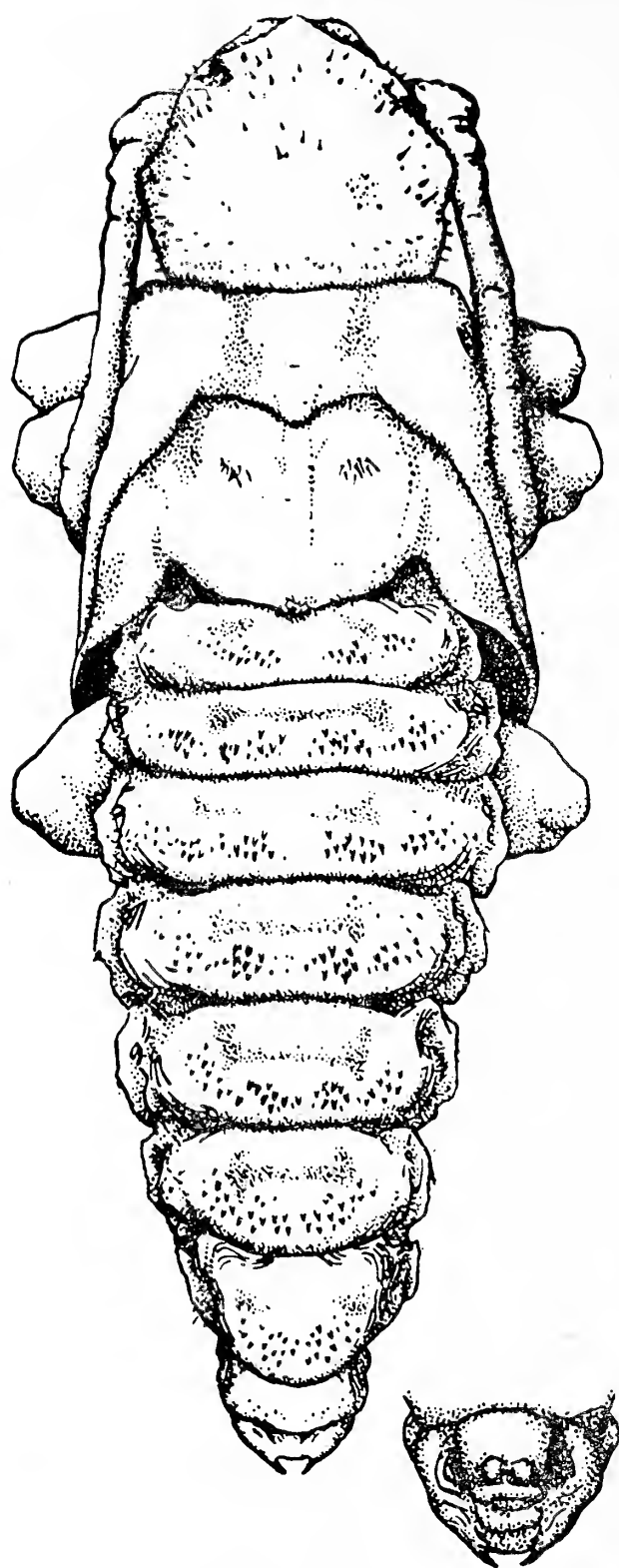
Pronotum transverse, 2.0 times wider than long, laterally with dense setaceous hairs encircled at base by sclerotized ringlet, sparse coarse hairs on disk, short fine, very dense hairs on whitish anterior margin, and transverse broad rust-speckled band in anterior third with one longitudinal whitish interception in middle and two on each side. Pro-
 429 notal shield rusty-brown, sclerotized, with dense minute spinules, deep longitudinal fold laterally, very dense white nonsclerotized punctation, and sparse (stray) setaceous hairs. Presternum speckled, with dense short rusty hairs, narrow sclerotized band on inner margin, and round rusty glabrous facet closer to base on sides. Propresternum bulges, entirely covered with fine dense hairs. Eusternum sclerotized, with minute spinules, rusty, with very dense white nonsclerotized punctation, and stray short setae in anterior half.

Abdomen laterally with dense rusty, not very long hairs. Locomotory ampullae developed on tergites I to VII, sclerotized, and covered with minute spinules. Abdominal tergite IX transverse, broadly rounded posteriorly, with short highly numerous hairs, sometimes glabrous in
 430 middle of posterior half. Pair of contiguous tubercular urogomphi at tip of abdomen terminate in small spinule. Body length of mature larvae 36 to 47 mm, width of head 6.5 to 7.0 mm.

Pupa (Figure 279): Characterized by elongate body, short pronotum transversely striate on disk, and urogomphi at tip of abdomen bent ventrad and inward. Head usually glabrous, with neither spinules nor setae, sometimes stray spinules near eyes, bulges transversely between antennae, flat or slightly impressed between upper lobes of eyes, rounded on occiput, and without perceptible tubercles. Antennae arcuate (female) or annular (male).

Pronotum bulges, not longer than wide, straightly truncate at base, narrows in anterior half; tubercularly produced or upwardly rounded medially on anterior margin, transversely striate on disk, with minute setae on protuberant coriaceous base laterally and on anterior margin. Meso- and metanota without spinules, rarely with spinules, transversely striate in middle.

Abdomen elongate, with parallel sides, and slightly (female) or markedly (male) narrows from segment V toward tip. Abdominal tergites bulge more in posterior half and here with short spinules, slightly obtuse or rounded, rarely pointed at apex; spinules directed backward and form transverse uneven band interrupted medially (on first four tergites) by common longitudinal groove. Tergite VII rounded posteriorly, with minute dense (male) or sparse (female) spinules on posterior margin



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Figure 279. Pupa of *Megasemum quadricostulatum* Kr., female.

and along sides. Tip of abdomen (ventral view) obtuse, bound laterally by coriaceous carina devoid of spinules and setae, and pair of urogomphi on dorsal margin produced terminally into long acute spine bent down and inward. Length of body 21 to 32 mm, width of abdomen 8.0 to 9.0 mm.

Material: From Ussuri-Primor'e region and Kunashir. Adult insects 54, larvae 199, pupae—eight males and two females.

Distribution: Covers eastern regions of Asia including Amur region, Primor'e, Sakhalin, and Kunashir; Japan and Korea.

Biology: Inhabits coniferous forests. Flight of beetles observed in July and August, partly in September. Beetles found on trunks and exposed roots of dead standing and felled fir trees. Female lays eggs in bark crevices. One female can lay up to 120 eggs.

Larvae initially live under bark, then bore into wood to a depth of 5.9 to 7.0 cm, making long galleries there along trunk, and plugging them compactly with fine frass. Galleries made by mature larvae broad, up to 20 to 25 mm in diameter, and sometimes fuse into extensive niches plugged with frass. Larvae make pupal cell at end of gallery in upper layer of wood along trunk. Length of cell 40 to 45 mm, width 15 to 16 mm.

In 1974 pupation of larvae was noticed mainly during July in Kunashir. Pupae maximum in second half of July. Young beetles emerged from last 10 days of July to end of August. Developed beetles nibble round openings 6.0 mm or more in diameter on trunk surface and abandon tree through them in July, August, or even early September. Weight indexes of insects in different stages vary widely. According to weight records of 15 insects, larvae before pupation weighed 420 to 1,485 mg (777.6 ± 81.5 mg), pupae 382 to 1,350 mg (704.3 ± 73.4 mg), and beetles 302 to 1,080 mg (551.3 ± 58.3 mg). I raised 40 beetles from larvae collected in nature, 31 of which came from fir, eight from maple, and one from spruce.

4. Genus *Asemum* Eschz.

Eschscholtz, 1830, *Bull. Soc. Nat. Moscou*, vol. 2, p. 66; Plavil'shchikov, 1940, *Fauna SSSR*, 22, 2, 20-21; Gressitt, 1951, *Longicorn Beetles of China*, vol. 2, p. 38; Linsley, 1962, *Cerambycidae of North America*, 19, pp. 78-79.

Adult: Distinguished by short broad head and finely faceted eyes. Elytra elongate, with parallel sides, and with longitudinal ridges. Pronotum broadly rounded laterally.

Larva: Characterized by markedly sclerotized yellowish-rust pronotal shield, fully sclerotized eusternum, and two tubercularly or conically produced proximate (not widely spaced) urogomphi on posterior end of abdominal tergite IX that terminate in dark brown spinule.

Pupa: Sides of head with projecting occipital protuberances. Pronotum angularly rounded laterally, with minute spinules [*A. striatum* (L.)] or with fine short setae on protuberant coriaceous base. Abdominal tergites with acute spinules forming tuft, and tip of abdomen with pair of long urogomphi terminating in sharp spinule bent downward, inward, and upward.

The genus *Asemum* is distributed in the Holarctic. Two species and one subspecies are known in northern Asia. Four species inhabit North America, of which *Asemum striatum* (L.) covers the Holarctic forest zone. All species are ecologically associated with coniferous vegetation.
Type species: Cerambyx striatum Linnaeus, 1758.

KEY TO SPECIES

Adult Insects

- 1 (4). Pronotum with dense granulate punctation.
- 2 (3). Pronotum in posterior half angularly broadens laterally, gradually narrows anteriorly, usually not narrower at base than at anterior margin. 1. **A. striatum** (L.).
- 3 (2). Pronotum broadly rounded laterally in middle, usually narrower at base than at anterior margin. 2. **A. s. amurense** Kr.
- 4 (1). Pronotum with simple deep punctation. 3. **A. punctulatum** Bless.

Larvae

- 1 (4). Urogomphi at posterior end of abdominal tergite IX large, usually conical, with pointed straight spinules terminally.
- 2 (3). Prosternum with sclerotized border on inner margin usually not reaching base of forelegs. Setae on inner lower margin of maxillary stipes not thicker than those on inner lobes (laciniae). 1. **A. striatum** (L.).
- 3 (2). Prosternum with sclerotized border on inner margin reaching base of forelegs. Setae on inner lower margin of maxillary stipes distinctly thicker than those on inner lobes (laciniae). 2. **A. s. amurense** Kr.
- 4 (1). Urogomphi at posterior end of abdominal tergite IX not large, in form of tubercles, with minute terminal spinule bent under and inward. 3. **A. punctulatum** Bless.

Pupae

- 1 (4). Pronotum laterally with highly numerous minute spinules.
- 2 (3). Abdominal tergite VII in posterior half with uniformly small spinules. Pronotum laterally (especially at base) with stray indistinct setae (female) or without them (male). 1. **A. striatum** (L.).
- 3 (2). Abdominal tergite VII in posterior half with large and small

specklike spinules. Pronotum laterally (especially at base) with highly numerous (female) or stray (male) minute setae.

. 2. *A. s. amurense* Kr.

4 (1). Pronotum laterally without spinules, only with minute setae set on protuberant coriaceous base. . . . 3. *A. punctulatum* Bless.

1. *Asemum striatum* (L.)

Linnaeus, 1758, *Syst. Nat.*, 10th ed., p. 396 (*Cerambyx*); Plavil'shchikov, 1940, *Fauna SSSR*, 22, 2, 22-24; Linsley, 1962, *Cerambycidae of North America*, 19, pp. 79-82.

Adult (Figure 280): Head markedly retracted into prothorax, steeply slopes anteriorly, with median longitudinal, sometimes faint suture, often with deep alveolar dent between upper lobes of eyes, and dense coarse punctation; spaces between punctures not larger than punctures per se; and light-colored hairs disposed like vortex on occiput. Antennae

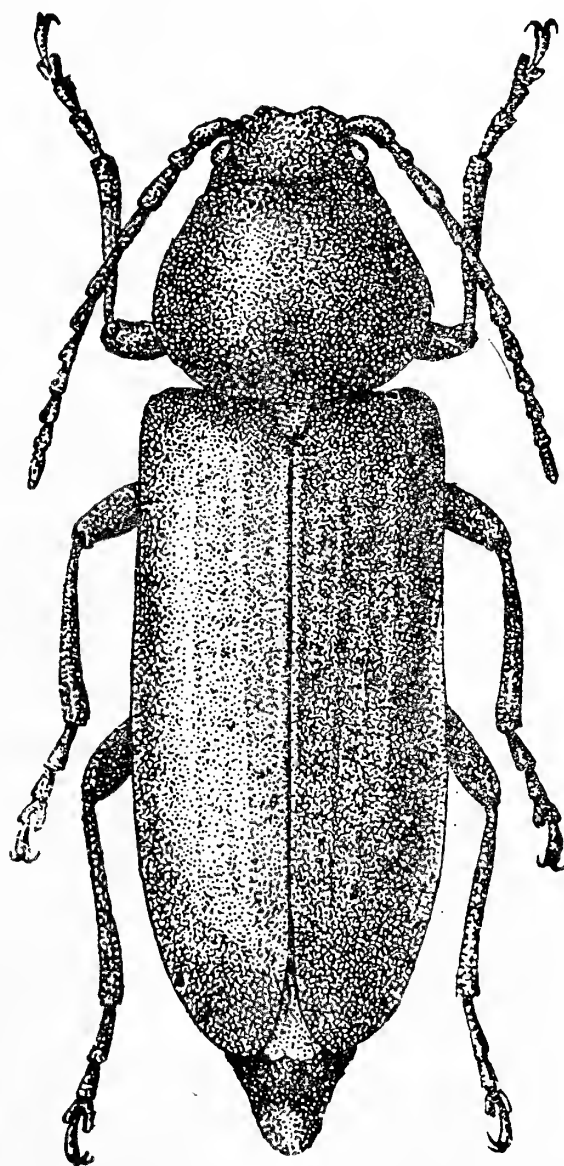


Figure 280. *Asemum striatum* (L.).

short; 8th or 9th segment reaches beyond base of elytra, 5th segment slightly longer (male) or not longer (female) than 3rd.

Pronotum laterally broadens angularly in posterior half, more gradually anteriorly, and steeply narrows posteriorly; much narrower at base than at anterior margin; with dense granulate punctation, fine light-colored hairs disposed like vortex, and uneven alveolar round or longitudinally extended depressions on disk. Scutellum flat, faintly elongate, with dense deep punctation, sometimes with smooth median longitudinal groove, gently rounded or straightly truncate at apex.

Elytra with parallel sides, individually rounded at apex, bulge, with longitudinal parallel ridges, and transversely striate between them; with close fine punctation and short adherent light-colored hairs. Legs comparatively short; femora dilated, hind tibiae longer than hind tarsi. First segment of hind tarsi almost not longer than two successive together, 3rd segment bifurcate over more than half length. Body, antennae, and elytra dark brown, black (f. *typica*); sometimes latter with light-colored ridge laterally (ab. *limbatipenne* Pic) or uniformly dark brown with red tinge (ab. *agreste* F.). Length of body 12 to 22 mm.

433 *Egg*: White, elongate, narrows more toward one end; rounded at poles. Chorion smooth, with cellular sculpture, lustrous. Length 1.2 to 1.4 mm, width 0.4 to 0.5 mm.

Larva (Figure 281): Characterized by deep, sometimes fused white punctation on pronotal shield, structure of sclerotized locomotory ampullae on segments I to VII, and arrangement of spinules at posterior

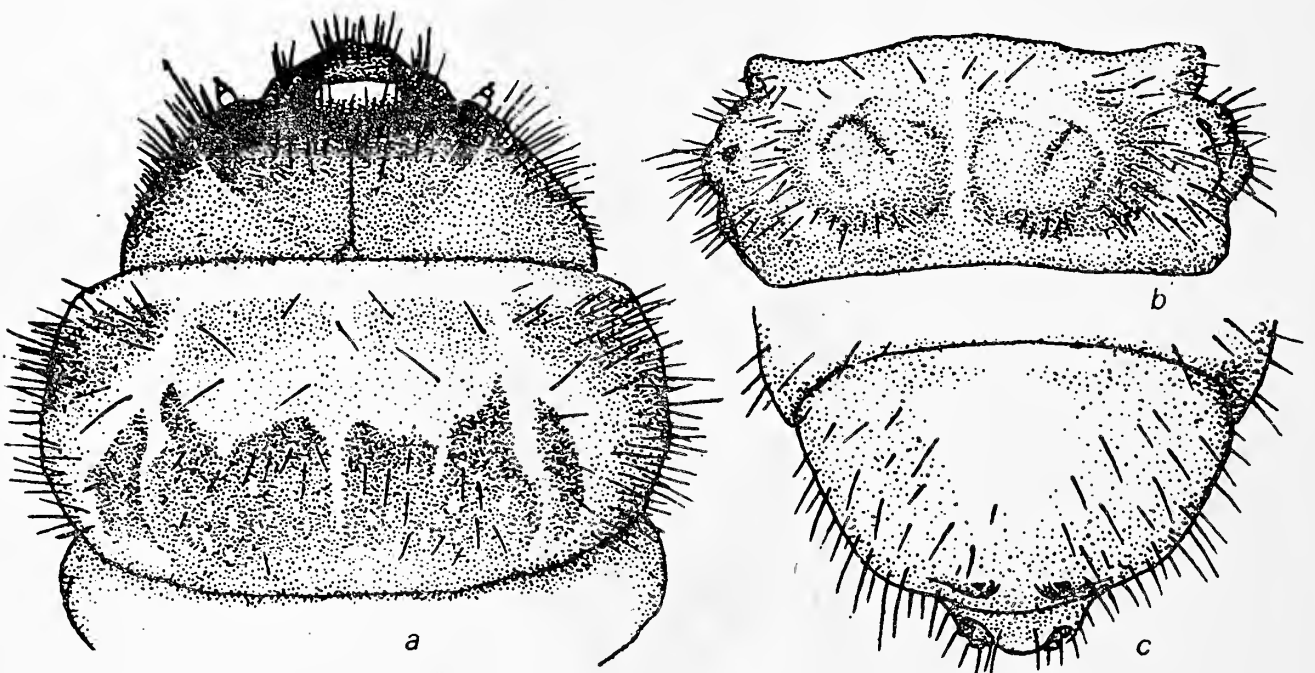


Figure 281. Larva of *Asemum striatum* (L.).

a—head and pronotum; b—tergite with locomotory ampulla; c—tip of abdomen.

end of abdominal tergite IX. Head narrowly rounded anteriorly, with dense long hairs laterally in anterior half. Epistoma flat, biapical posteriorly, with broad black or blackish-brown border on anterior margin, setaceous hairs anterior to middle forming transverse band, and bound laterally by distinct white frontal sutures. Longitudinal suture blackish-brown, uniformly sharp throughout its length. Hypostoma bulges distinctly, slightly rounded laterally, slightly narrows anteriorly, and almost 2.0 times wider than long; white gula in middle and dispersed setaceous hairs in anterior half. Clypeus broad, bulges slightly, lustrous, brown basally, and narrows anteriorly. Labrum reddish-brown or dark rust, notably elongate, angularly and narrowly rounded apically, with short setae along margin, long setae behind middle closer to base, glabrous in middle and entirely without setae. Mandibles apically with rostriform produced denticle, semicircularly notched upward at cultrate edge and matte here, with small subapical denticle, and three long thin carinae on inner surface; of these carinae, lower and middle ones extend toward lower denticle and upper one toward subapical denticle.

Pronotum transverse, 2.0 times wider than long, slightly slopes anteriorly, with dull yellowish transverse band in anterior half interrupted medially and laterally by white longitudinal clearances, dense setaceous hairs laterally, and stray ones on disk. Pronotal shield bulges, highly sclerotized, yellowish-rust, with deep white, much larger, often fused punctation basally, deep longitudinal grooves laterally, usually with two emarginations on anterior margin and anterior angles produced forward, median longitudinal groove extending posteriorly almost up to posterior half; folds lateral to longitudinal grooves sclerotized, rusty-yellow, with minute spinules. Presternum with dense short setaceous hairs and
 434 yellowish-brown spots. Sclerotized band on inner margin. Eusternum bulges slightly, uniformly sclerotized, with short setaceous hairs in anterior half, without them in posterior half.

Abdomen laterally with comparatively dense rusty hairs. Dorsal locomotory ampullae divided in middle by longitudinal groove, laterally bulge tubercularly, uniformly sclerotized, with minute brownish spinules, convex longitudinal fold laterally and grooved dent extending from it obliquely on anterior margin inward. Ventral locomotory ampullae sclerotized, bulge, with longitudinal fold laterally, and more or less distinct median transverse groove. Abdominal tergite IX transverse, basal width greater than length, with light-colored hairs, glabrous at base; one pair of contiguous tubercles or urogomphi at tip terminate in dark brown, almost black or rusty-red spinule. Body length of mature larvae 20 to 22 mm, width of head 4.5 mm.

Pupa (Figure 282): Distinguished from pupae of other species of the genus *Aseum* in disposition and form of spinules on abdominal seg-

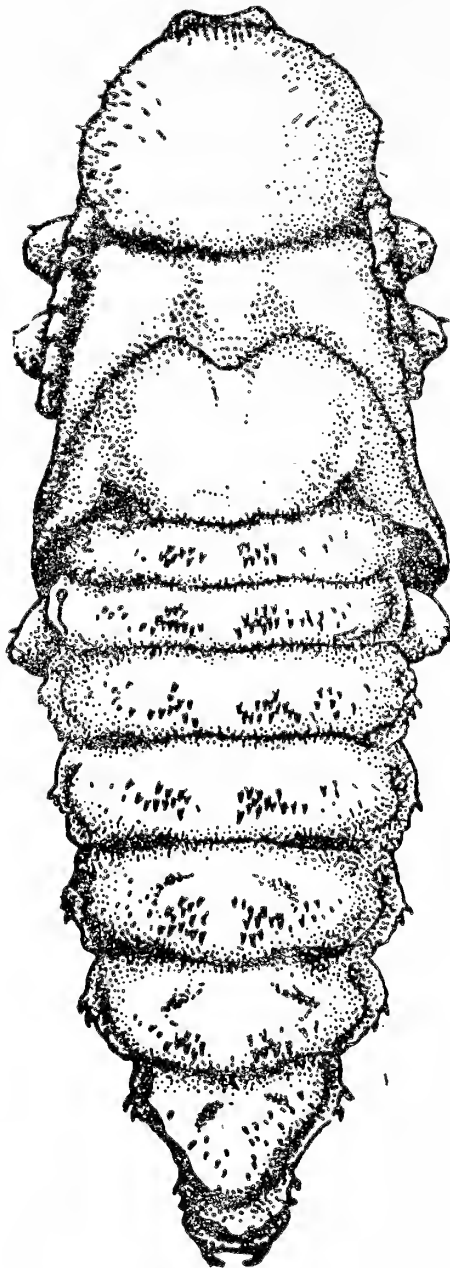


Figure 282. Pupa of *Asemum striatum* (L.).

ments. Head short, flat between upper lobes of eyes, generally with more (male) or less (female) distinct occipital protuberances, covered with minute spinules; and stray spinules laterally forming transverse row extending from posterior inner margin of eye toward occipital protuberance. Antennae short, flexed to sides, slightly curved, with apices extending beyond midtibiae.

Pronotum bulges slightly, flat on disk, angularly broadens in posterior half; with fine striation and minute spinules mainly along periphery. Meso- and metanota bulge slightly, with sparse, very minute spinules or without them.

Abdomen moderately elongate, gradually narrows posteriorly. Abdominal tergites bulge in posterior half, with common median longitudinal groove, and dense spinules along sides of groove forming triangular

tuft extending laterally. Spinules markedly flattened laterally, bent backward, sometimes set on common longitudinally elongate base, and hence quite often appear to be bi- or triapical. Posterior margin of tergite VII rounded, with dense large spinules in male or sparse minute ones in female in posterior half. Abdominal sternites laterally with tubercular protuberances covered with highly numerous acute spinules. Tip of abdomen obtuse ventrally, bound laterally by coriaceous carina devoid of spinules, and with widely separated urogomphi at end that terminate in long acute spinules bent down and toward each other. Valvifers of female small, hemispherical or conical. Length of Body 18 to 20 mm, width of abdomen 5.0 mm.

435 *Material:* From Yakutia, Magadan, Baikal region, Tuva, Upper Ob' region, and eastern Ural region. Adult insects 549, larvae 120, pupae—three males and five females. Large series of larvae and pupae raised in the laboratory.

Distribution: All of Europe, northern Asia, and North America within coniferous range. Extends in northern Asia from transpolar forest-tundra to northern Mongolia and northern China.

Biology: Inhabits coniferous forests. Seen in biocenoses of plains of taiga and mountain forest belt. Flight of beetles commences in May and continues up to August inclusive. Of the 136 insects collected in Altai, 2.2% were found in May, 46.3%—June, 47.8%—July, and 3.7%—August.

In Magadan in Kolyma region 126 beetles were collected, including 75 (59.5%) in June, 48 (38.1%)—July, and three (2.4%)—August. Beetles disappear in mid-August. They lead a cryptic mode of life, are not seen on flowers, and restricted to coniferous trees. Female colonizes exposed roots, basal zone of trunk of decomposing trees, and fresh stumps, mainly of Scots pine (*Pinus sylvestris*), Siberian stone pine (*Pinus sibirica*), Siberian spruce (*Picea obovata*), rarely Siberian larch (*Larix sibirica*), and other coniferous species.

Female lays eggs in bark crevices. Capable of laying considerable number of eggs. Ovaries of one female dissected nine days after emerging from wood contained 80 fully mature eggs. Larvae hatch two to three weeks after oviposition. In 1967 I studied the development of 93 eggs in Lake Telets region. Embryonic development at 5.0 to 27.0°C (mean daily temperature $14.1 \pm 0.9^\circ\text{C}$) took 15 to 24 days, average 16.4 ± 0.3 days.

Hatching of larvae commences in early July and concludes by end of August. Larvae initially live under bark, then bore into wood, and plug galleries behind them with fine frass. Mature larva makes cell in wood transversely inclined or, rarely, longitudinal, leaving an outer layer of wood 1.0 to 2.0 mm thick. Sometimes pupal cell (especially in

thick-barked trees) extends partly into inner bark layer. Length of cell 25 to 30 mm, width 7.0 to 11.0 mm.

Pupation of larvae commences end of April, terminates in June. Pupae maximum mid-June. Beetles emerge three weeks later from pupae. Developed beetles nibble oval flight openings (5.0 mm \times 4.0 mm to 6.0 mm \times 4.0 mm) on bark surface and abandon wood in May-June, often in early July.

I collected two beetles, four pupae, and two larvae before pupation near Lake Telets on June 10 from the basal zone of a viable maple (in region of dry trunk). Life cycle completed in less than two years. During metamorphosis weight reduction is significant. For example a pupa weighed 194 mg (100%) and the adult developed from it 140.5 mg (70.2%), i.e., weight reduction 29.8%. According to my observations, weight of larvae before pupation 45 to 481 mg (233.4 ± 21.9), pupae 39.5 to 400.0 mg (199.2 ± 18.3), and young beetles before emerging from wood 30.0 to 221.5 mg (144.8 ± 11.2). Larval development is greatly impeded in dry wood, and stunted forms usually develop there. Larvae usually found on thick-barked trees. From natural wood cuttings colonized by larvae in the laboratory, the following were recovered: 40 beetles from maple, 32—pine, 11—spruce, and one—larch. *Spondylis buprestoides* (L.), *Tetropium castaneum* (L.), and others sometimes colonize together with this species.

436 2. *Aseum striatum amurense* Kr.

Kraatz, 1879, *Deutsch. Entom.*, vol. 23, p. 97; Plavil'shchikov, 1940, *Fauna SSSR*, 22, 2, 24; Hayashi, 1958, *Entom. Rev. Japan*, vol. 9, p. 60.

Adult: Close to *Aseum striatum* (L.). Differs in features that are difficult to discern: pronotum usually narrower posteriorly than anteriorly, uniformly rounded laterally, male genitalia broader, and parameres not straight (as in *A. striatum*) but slightly convex. Head short, uneven, with deep longitudinal, sometimes grooved suture medially, rarely smooth between upper lobes of eyes, gently narrows posteriorly, with close deep punctation and light-colored adherent hairs. Genae coarsely punctate, almost as long as width of lower lobe of eyes. Seventh (male) or 9th (female) segment of antennae extends beyond base of elytra; 1st segment thick, width 0.50 length, with large punctation.

Pronotum laterally rounded, narrows more posteriorly, usually less wide there than anteriorly; with dense granulate punctation, tender light-colored hairs, and oval, often longitudinally elongate dent on disk. Scutellum broad, with parallel sides, broadly rounded apically.

Elytra elongate, almost 2.5 times longer than wide, with longitudinal ridges, rugose punctation, and adherent rusty hairs; individually rounded at apex, and narrowly marked inner angles. Apical abdominal tergite

in male (ventral view) markedly projects beyond posterior margin of sternite V, with carinate edge. Male genitalia broad, parameres convex medially, with apices proximate; thin piliform setae terminally. Body, antennae, legs, and elytra black or dark brown (f. *typica*) or elytra light rust, rusty-brown (ab. *similis* Plav.) or elytra dark brown, black with light rust border laterally (ab. *limbatum* Plav.). Length of body 8.0 to 22.0 mm.

Egg: White, with parallel sides, narrows at one pole, sometimes slightly pointed here, broadly rounded at the other. Chorion smooth, lustrous, without perceptible sculpture. Length 1.5 mm, width about 0.5 mm.

Larva: Very similar to larva of *Asemum striatum* (L.). Differs in reddish-rust hair cover, eusternum broadens more basally, and in disposition of hair cover on abdominal tergites VII to IX. Head round, narrows anteriorly, with dense long hairs laterally in anterior half, especially on anterior margin close to frontal sutures. Epistoma flat posteriorly, with two broad pointed apices, broad smooth transverse blackish-brown band on anterior margin, and stray setaceous hairs behind this band not forming distinct transverse row [in *Asemum striatum* (L.) they form distinct transverse row]. Hypostoma bulges markedly, with narrow longitudinal gula, and very dense thick setaceous hairs [in *A. striatum* (L.) hairs usually thin]. Labrum brownish-red or dark rust, glabrous on disk, with short setae laterally and long ones at base. Mandibles with lower denticle projecting apically, notched in tapered cultrate edge, matte and striate here; underside with elongate facet bearing three to four sharply projecting longitudinal carinae, of which two lower ones extend from base to apex of lower denticle, and one to two upper ones toward subapical denticle. Inner lower margin of maxillary stipes with thick setae, inner side of laciniae with thin dense setae [in *A. striatum* (L.) these setae are usually thin and equal in size].

437 Pronotum in anterior half with broad yellow transverse band, dense reddish-rust hairs laterally, stray ones on disk, forming two transverse rows—one before shield, the other at site of yellow transverse band. Pronotal shield sclerotized, with sharp rusty-yellow tinge, round white pubescent punctation, large longitudinally elongate white punctation in posterior half without hairs, deep longitudinal folds laterally, two deep notches on anterior margin, narrow longitudinal groove in middle of anterior half, usually with markedly elongate anterior angles. Outer side of lateral longitudinal fold sclerotized, forms broad yellow longitudinal band. Presternum with short rusty setaceous hairs on inner side, with sclerotized border reaching base of forelegs [in *A. striatum* (L.) this border usually far short of reaching base of forelegs]. Eusternum bulges moderately, entirely sclerotized, with hairs dispersed in anterior half.

Abdomen laterally with thick reddish-rust setaceous, comparatively dense hairs. Dorsal locomotory ampullae bulge, with broad median longitudinal groove, bound laterally by convex longitudinal fold interrupted anteriorly by slight transverse groove, with fold extending from anterolateral angles inward and posteriorly. Ventral locomotory ampullae entirely sclerotized, interrupted by transverse groove joining laterally with convex longitudinal bracket-shaped fold turned outward. Abdominal tergite IX at posterior end with pair of conical, comparatively large urogomphi that are insignificantly separated and terminate apically in reddish-brown acute spinule. Body length of mature larvae 25 to 30 mm, width of head 5.0 mm.

Pupa: Very similar to pupa of *Asemum striatum* (L.) and almost not distinguishable from it. Some of its distinctive features are: Head more impressed anterior to lateral occipital protuberances [in *Asemum striatum* (L.) it is usually flat here] and two to three (male) or four to six (female) spinules form tuft on anterior margin along sides at base of clypeus [in *A. striatum* (L.) with two spinules in female or without them in male]. Pronotum laterally, especially closer to base, with spinules and highly numerous minute setae (female) or stray ones (male) [in *A. striatum* (L.) with spinules and only stray setae]. Abdominal tergite VII in posterior half with large and minute specklike spinules [in *A. striatum* (L.) spinules here usually minute and identical]. Length of body 13 to 22 mm, width of abdomen 4.0 to 5.0 mm.

Taxonomic remarks: *Asemum amurense* Kr. has been treated to date as an independent species. However, to distinguish it from *Asemum striatum* (L.) on the basis of morphological features in different developmental stages is almost impossible. In large collections a general variation in pattern of features (gradual transition) is evident from the typical nominal form [*A. striatum* (L.)] to the Far Eastern Amur form (*A. s. amurense* Kr.). In my opinion, therefore, there is no justification for regarding the latter as an independent species, especially since it is ecologically monotypic with the former.

Material: From Ussuri-Primor'e region, Sakhalin, and Kunashir. Adult insects 41, larvae 324, pupae—four males and five females. Series of larvae and pupae raised in the laboratory.

Distribution: East of Siberia within Ussuri-Primor'e region, Sakhalin, and Kunashir; Japan, North Korea, and northern China.

Biology: Confined to coniferous forests. Beetles sighted end of May, disappear in August. Maximum in last 10 days of June and first half
438 of July. Beetles lead a cryptic mode of life, often creep onto decaying trees and fresh stumps, mate, and oviposit there. Ovaries of one female (weight 105.4 mm) dissected four days after emergence from wood contained 148 eggs. Beetles are capable of reproducing without supplemen-

tary feeding. They colonize thick exposed roots and basal zone of trunks of coniferous trees. Female lays eggs in bark crevices. Larvae hatch from eggs in 2.5 to 3.0 weeks after oviposition. Under laboratory conditions at 17.4°C embryonic development took 12 to 17 days.

Larvae initially live under bark, bore into wood the following summer, leaving an oval exit (5.0 mm × 2.5 mm) on surface of alburnum. Galleries made in wood by larvae are longitudinal and plugged with frass, sometimes with fibrous frass. After second hibernation larva makes cell at end of gallery along or oblique to trunk surface and pupates in it. Length of pupal cell 35 to 65 mm, width 7.0 to 12.0 mm.

Pupation of larvae observed from May to end of June. Beetles emerge from pupae three weeks later. Emergence of beetles from wood in Ussuri-Primor'e region from 1971 to 1973 recorded mainly in June and early July, and in Kunashir in 1974 in first 10 days of July. Weight of larvae before pupation 65 to 324 mg, pupae 58 to 288 mg, and young beetles 48.8 to 279.0 mg. *A. s. amurense* mainly attacks maple. Thus from wood cuttings colonized by larvae the number of beetles recovered from Korean maple was 56, spruce—seven, fir—one, and Japanese stone pine—one.

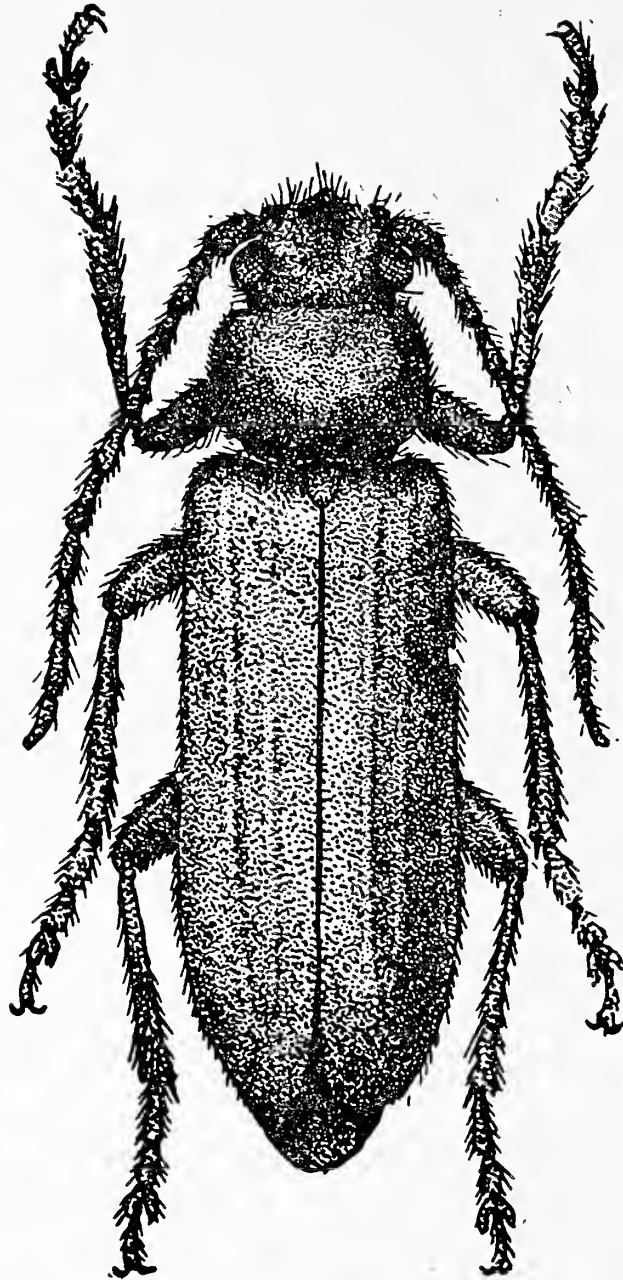
3. *Asemum punctulatum* Bless.

Blessig, 1872, *Hor. Soc. Entom. Ross.*, vol. 9, p. 182; Plavil'shchikov, 1940, *Fauna SSSR*, 22, 2, 25–27; Hayashi, 1958, *Entom. Rev. Japan*, vol. 9, p. 60.

Adult (Figure 283): Readily distinguished from other species of the genus *Asemum* by simple punctation on pronotum. Head more elongate, eyes markedly removed from anterior margin of pronotum, gently rounded on occiput, flat between upper lobes of eyes, with deep, comparatively close punctation, light-colored hairs, and flat frontal tubercles at bases of antennae on inner side. Antennae highly pubescent, with dense setaceous semiadherent hairs; 3rd antennal segment shorter than 5th; equal to 4th or slightly longer.

Pronotum gently narrows anteriorly and steeply and roundly posteriorly, notably transverse, bulges slightly on disk, almost flat, with insignificant faint round dents laterally and medially on base, simple deep close punctation, and short light-colored hairs. Pronotal disk lustrous, broadly rounded posteriorly, gently impressed.

439 Elytra elongate, with parallel sides, gently taper at apex on outer side, with rounded inner angles, longitudinal ridges on disk, without transverse striation, with minute punctation and dense short semiadherent hairs. Hind tarsi shorter than tibiae, 1st segment equal to two successive ones together or slightly longer. In abdomen sternite V (male) transverse, broadly rounded posteriorly, and last tergite (ventral view)



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Figure 283. *Asemum punctulatum* Bless.

projects slightly beyond tip. Body blackish-brown, with rusty tinge (f. *typica*), sometimes elytra pitch-brown, with reddish border laterally (ab. *marginatum* Plav.), rarely elytra entirely reddish (ab. *fulvum* Plav.). Length of body 7.0 to 14.0 mm.

Egg: Elongate, narrows gradually toward one end, rounded at both poles. Chorion smooth and lustrous. Length 1.1 mm, width 0.4 mm.

Larva (Figure 284): Characterized by bulging epistoma, short pronotal shield, and small urogomphi at posterior end of abdominal tergite IX. Head laterally covered with dense long hairs almost throughout its length. Epistoma bulges, with two short broad apices posteriorly, black or dark brown border on anterior margin, and median longitudinal dark brown suture. Sides of frontal sutures straight and white, well defined. Hypostoma bulges, rounded laterally, narrows more anteriorly,

1.5 times longer laterally than medially in region of gula, and with fine hairs in anterior half. Clypeus trapezoidal, markedly narrows anteriorly, white. Labrum dark brown, elongate, narrows anteriorly, narrowly rounded angularly at apex, glabrous on disk, with long setae along margins and at base. Mandibles with rostriform projecting lower denticle, broadly notched upward along cultrate edge, with gently projecting intermediate subapical denticle; inner side with five longitudinal carinae, of which three lower ones extend toward apex of lower denticle and two short parallel ones toward intermediate denticle. Pronotum 2.5 times wider than long, insignificantly slopes anteriorly, with long dense hairs laterally, stray ones on disk, with dull yellowish transverse band in anterior third.

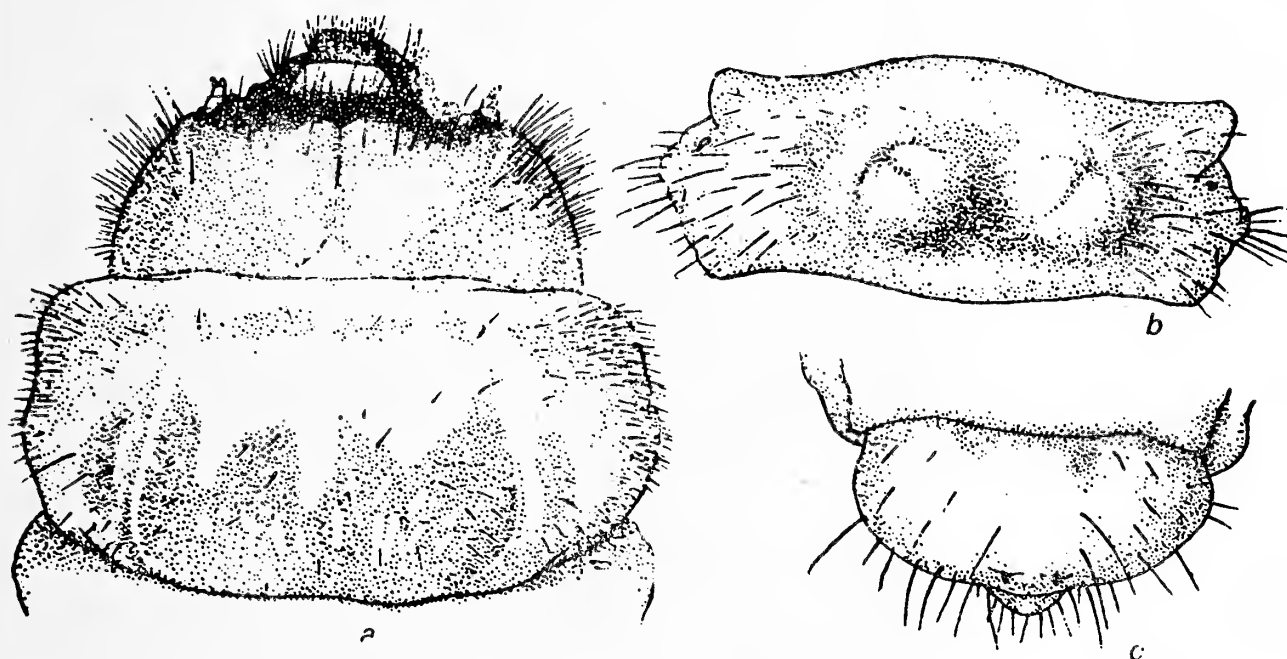


Figure 284. Larva of *Asemum punctulatum* Bless.
a—head and pronotum; b—abdominal tergite
with locomotory ampulla; c—tip of abdomen.

Pronotal shield bulges, yellowish-rust, sclerotized, with small round white punctation in anterior half, and large longitudinally elongate ones in front of base, longitudinal deep folds laterally, notched on anterior margin along sides, longitudinal nonsclerotized groove in middle of anterior half, and sometimes with anterior angles markedly produced. Presternum with even setaceous hairs, laterally with glabrous, lustrous, sometimes yellowish facet, on inner margin with yellowish sclerotized border. Eusternum bulges, entirely sclerotized, with fine setaceous hairs in region of round nonsclerotized white punctation.

Abdomen laterally with sparse fine hairs and well-developed locomotory ampullae on segments I to VII. Dorsal locomotory ampullae bulge, roundly tubercular, sclerotized, divided by common median longitudi-

nal groove, with radial dent on anterolateral angles formed by two overlapping grooves. Ventral locomotory ampullae bulge, sclerotized, laterally with longitudinal groove, medially with short transverse groove deviating from longitudinal one. Abdominal tergite IX bulges, almost semicircular, with stray thin long hairs laterally, pair of small spinescent tubercles apically, with spinules bent down and inward. Length of mature larvae 13 to 15 mm, width of head about 3.0 mm.

Pupa (Figure 285): Similar to pupa of *Asemum striatum* (L.). Distinguished from it by absence of spinules on sides of pronotum and presence of fine light-colored hairs set on protuberant coriaceous base. Head short, broad, glabrous, with neither spinules nor setae; with stray faint fine hairs only on projecting rounded occipital protuberances. Antennae flexed to sides, curve around midlegs, with apices terminating midlength of metathorax.

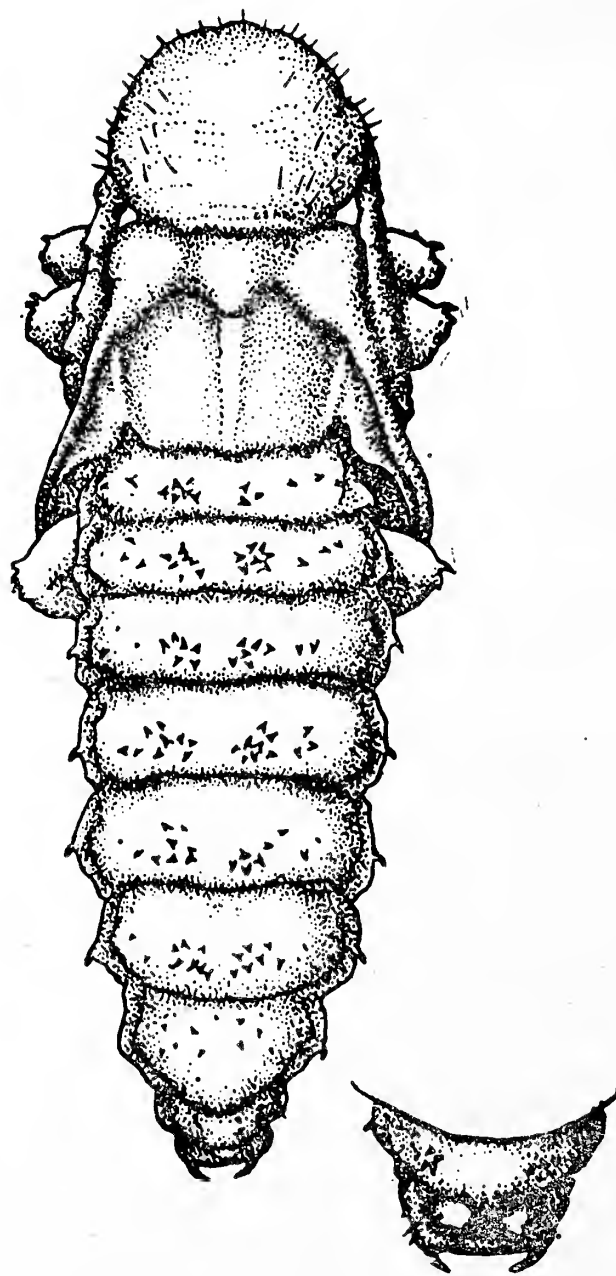


Figure 285. Pupa of *Asemum punctulatum* Bless., female.

Pronotum bulges slightly, broadens angularly, narrows anteriorly and posteriorly, flat on disk, glabrous, without spinules, with fine hairs only laterally set on protuberant coriaceous base. Meso- and metanota glabrous, lustrous. Hind femora apically on front side with two to three long acute spinules darkened terminally.

Abdomen in region of segments III to V enlarged, gradually narrows posteriorly. Abdominal tergites with rather narrow common median longitudinal groove, minute acute spinules along its sides and broad ones at base, latter forming tuft (seven to eight spinules) with individual spinules lateral to it often constituting an additional lateral tuft. Pleural tubercles with spinule bent backward. Abdominal sternites laterally with tubercular convexity covered with numerous minute spinules. Tip of abdomen obtuse, bound laterally by carina set with two to three
 441 acute sclerotized spinules, and pair of urogomphi at end that terminate in long acute sclerotized spinule bent under markedly toward middle. Valvifers of female hemispherical, with faint apical tubercle. Length of body 9.0 to 14.0 mm, width of abdomen 3.5 mm.

Material: Collected in Ussuri-Primor'e region, Sakhalin, and Kunashir. Adult insects 28, larvae 41, pupae—three males and three females. We raised 68 beetles in the laboratory.

Distribution: Amur basin, Ussuri-Primor'e region, Sakhalin, and Kunashir; Japan, Korea, and northern China.

Biology: Inhabits coniferous vegetation. Flight of beetles observed from June to first half of August. Sporadic. Female lays eggs in bark crevices on thick-trunked decaying or physiologically weakened standing Korean pine (*Pine koraiensis*); colonizes trunk from root neck to 10 m and above. Ovaries of one virgin female dissected nine days after emerging from wood contained 120 eggs. Under laboratory conditions development of eggs from time of oviposition to hatching of larvae took 14 to 21 days, average 17.3 days.

Young larvae bore into bark and make galleries underneath it without affecting sapwood. Later, after first hibernation, larvae bore into wood and usually make galleries in upper layer in longitudinal or transverse direction, and plug them with fine frass. After second hibernation larva makes cell at end of gallery along or across trunk. Sometimes exit nibbled from cell to trunk surface and firmly plugged with fibrous frass. Length of pupal cell 25 to 30 mm, width 6.0 to 10.0 mm. Larva pupates with head toward exit.

Pupation commences in May and concludes end of June. Pupae develop in about three weeks. For example, under laboratory conditions, one larva ready for pupation by February 11, pupated on February 16, and the adult emerged from this pupa on March 4th. Young beetles sighted in June and July. They make oval openings (4.0 mm × 3.0 mm

or 5.0 mm × 4.0 mm) on trunk surface and escape from wood through them. Life cycle completed in two years. Weight of larvae before pupation 38.4 to 158.2 mg (83.8 ± 5.7), pupae 34.0 to 103.2 mg (71.9 ± 3.9), and young beetles before emerging from wood 23 to 83 mg (52.6 ± 3.3).

Asemum punctulatum Bless. lives in decaying maple together with *Asemum striatum amurense* Kr. The former is seen on trunks and the latter on exposed roots and basal zone of trunk.

5. Genus *Tetropium* Kirby

Kirby, 1837, *Fauna Bor. Amer.*, p. 174; Plavil'shchikov, 1940, *Fauna SSSR*, 22, 2, 27-28; Linsley, 1962, *Cerambycidae of North America*, 11, 19, 85-86.

Adult: Body elongate. Head short, eyes finely faceted, highly emarginate, divided into upper and lower lobes with narrow septum between them. Apices of antennae barely extend beyond middle of elytra or short of this level; 1st segment thick and short. Pronotum laterally rounded, transverse apically, with very fine punctation. Legs short; distal half of femora highly dilated.

Egg: Elongate, rounded at poles and here with thin rough or flat cellular sculpture.

Larva: Distinguished from larvae of other genera by white band laterally on head and piliform sclerotized tubercles, or reddish-rust pubescent sclerotized speckles in anterior half on whitish background.
442 Abdominal tergite IX on posterior end with pair of small spinules set on common tubercular protuberance.

Pupa: Characterized by moderately elongate body. Antennae arcuate, outer side with acute spinules. Pronotum laterally rounded, disk flat, and with or without lateral longitudinal grooves. Abdominal tergites with acute spinules forming tuft or transversely elongate, laterally narrowing band along sides of longitudinal groove. Tip of abdomen with pair of widely separated urogomphi that terminate in long subulate spinule bent under and inward.

Seven species inhabit the Palearctic. Of these, two species are widely distributed in northern Asia and two species have reached from Europe into western Siberia. In North America six species are presently known. All species of the genus *Tetropium* live on coniferous wood species. They generally colonize highly weakened and recently dead trees, and damage drying bast.

Type species: *Tetropium cinnamopterum* Kirby, 1837.

KEY TO SPECIES

Adult Insects

- 1 (4). Pronotum and elytra with short, not very dense hairs, that do not form compact cover.
- 2 (3). Head between antennae with deep longitudinal suture, as though longitudinally impressed. Antennae thick, with apical segments distinctly thickened, nodose. Pronotum with very sparse dispersed punctation on disk. 1. **T. castaneum** (L.).
- 3 (2). Head between antennae even, not impressed, only sometimes with faint longitudinal suture. Antennae thin, with segments gradually thickening insignificantly toward apex. Pronotum with dense punctation on disk; spaces between punctures marginally larger than punctures per se. 2. **T. gracilicorne** Reitt.
- 4 (1). Pronotum and elytra with long dense hairs forming (in some specimens) compact cover.
- 5 (6). Elytra straw-yellow, with broad, transverse, light-colored, pubescent band at base. 3. **T. fuscum** (F.).
- 6 (5). Elytra dark brown or reddish-brown, monochromatic, without broad transverse light-colored band at base.
. 4. **T. aquilonium** Plav.

Larvae

- 1 (2). Spinules at posterior end of abdominal tergite IX high and elongate, slightly longer than width at base, and pressed against each other. 1. **T. castaneum** (L.).
- 2 (1). Spinules at posterior end of abdominal tergite IX not high, usually shorter than width at base, and not pressed against each other; separated by interception almost equal to diameter of spinule.
- 3 (4). Hairs with sclerotized base on parietals in anterior half form compact dense tufts (20 to 25 hairs per tuft). Spinules at posterior end of abdominal tergite IX specklike, without even an indistinct sclerotization at base. 2. **T. gracilicorne** Reitt.
- 4 (3). Hairs with sclerotized base on parietals in anterior half form sparse tufts (usually 10 to 14 hairs per tuft). Spinules at posterior end of abdominal tergite IX look like spots, with indistinct sclerotization at base, and cover significant part of tubercle on which they are set. 3. **T. fuscum** (F.).

Pupae

- 1 (2). Mesonotum markedly raised tubercularly at apex and here with large spinules visible under low magnification. 1. **T. castaneum** (L.).
- 2 (1). Mesonotum not raised at apex, bulges insignificantly, and here without large spinules.
- 3 (4). Longitudinally grooved folds on pronotal disk distinctly diverge anteriorly. 2. **T. gracilicorne** Reitt.
- 4 (3). Longitudinally grooved folds on pronotal disk do not diverge anteriorly, parallel. 3. **T. fuscum** (F.).

1. **Tetropium castaneum** (L.)

Linnaeus, 1758, *Syst. Nat.*, 10th ed., p. 396 (*Cerambyx*); Plavil'shchikov, 1940, *Fauna SSSR*, 22, 2, 29-32; Kojima and Hayashi, 1969, *Insect Life in Japan*, vol. 1, p. 44.

Adult (Figure 286): Distinguished from other species of genus by very thick antennae, markedly dilated (thickened) femora, and sparse pronotal punctation. Head with deep median longitudinal suture, tubercularly produced at base of antennae, with more or less distinct dent on vertex between upper lobes of eyes, and uneven, often obliterated punctation on vertex and especially on occiput. Eyes markedly emarginate on inner side; septum between upper and lower lobes with not more than single row of facets. Antennae thick, setaceous, thicken at base, markedly narrow toward apex, with apices barely extending beyond middle of elytra (male) or even not reaching this level (female). First antennal segment thick, width 0.50 length; 2nd to 7th segments notably thicken apically, nodose.

Pronotum laterally rounded, broadens in anterior third (male) or in middle (female), slightly elongate (male) or transverse (female), with slight transverse groove apically, more distinct transverse groove basally, longitudinal dent in middle, and sometimes rounded dent along sides; with diffuse or very sparse simple punctation on disk, and dense, granulate punctation on sides, and readily abraded thin hairs. Scutellum
444 with parallel side, broadly rounded posteriorly, bulges, sometimes flat with longitudinal broad groove, smooth, with minute punctation at base.

Elytra bulge moderately, parallel, rounded apically, with two longitudinal ridges on disk, dense very fine punctation, and fine hairs. Femora markedly dilated. First segment of hind tarsi slightly shorter or almost as long as successive two together. Body black, elytra light brown with rusty tinge (f. *typica*), or body and elytra black, legs and antennae reddish-rust or reddish-brown (ab. *fulcratum* F.), or body, elytra, legs,

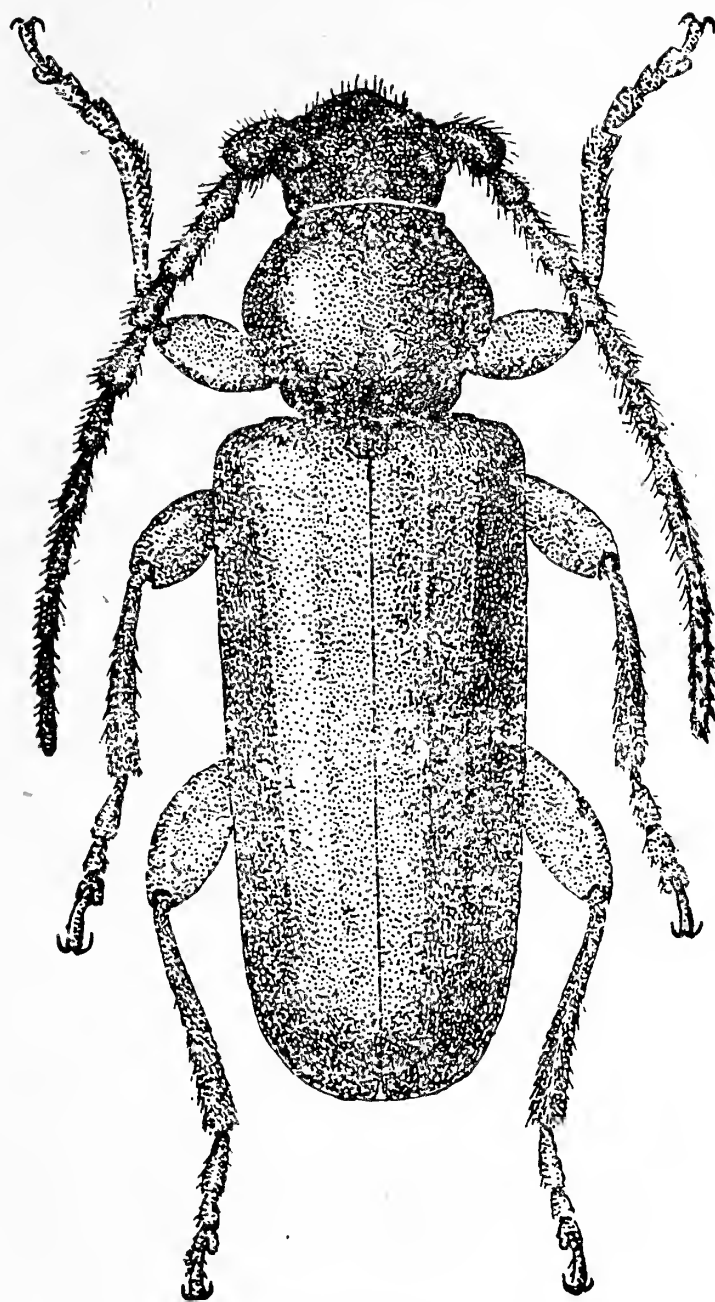


Figure 286. *Tetropium castaneum* (L.).

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and antennae black (ab. *aulicum* F.), or body, antennae, and legs black, elytra lighter in color, brownish (ab. *luridum* L.). In general, light-colored forms predominate in plains and much darker ones in high altitudes. Length of body 8.0 to 17.0 mm.

Egg: White, broadly rounded at one pole, narrowly at the other, and narrows more toward one end. Chorion with minute, very fine, coarse microsculpture, imparting a silvery tone. Length 1.2 mm, width 0.5 mm.

Larva (Figure 287): Characterized by broadly impressed epistoma, presence of sclerotized pubescent granules laterally on head, and structure of spinules at posterior end of tergite IX. Head transverse, narrowly rounded anteriorly, reddish-rust, whitish around frontal sutures in posterior half and laterally, with pubescent sclerotized dark red granules

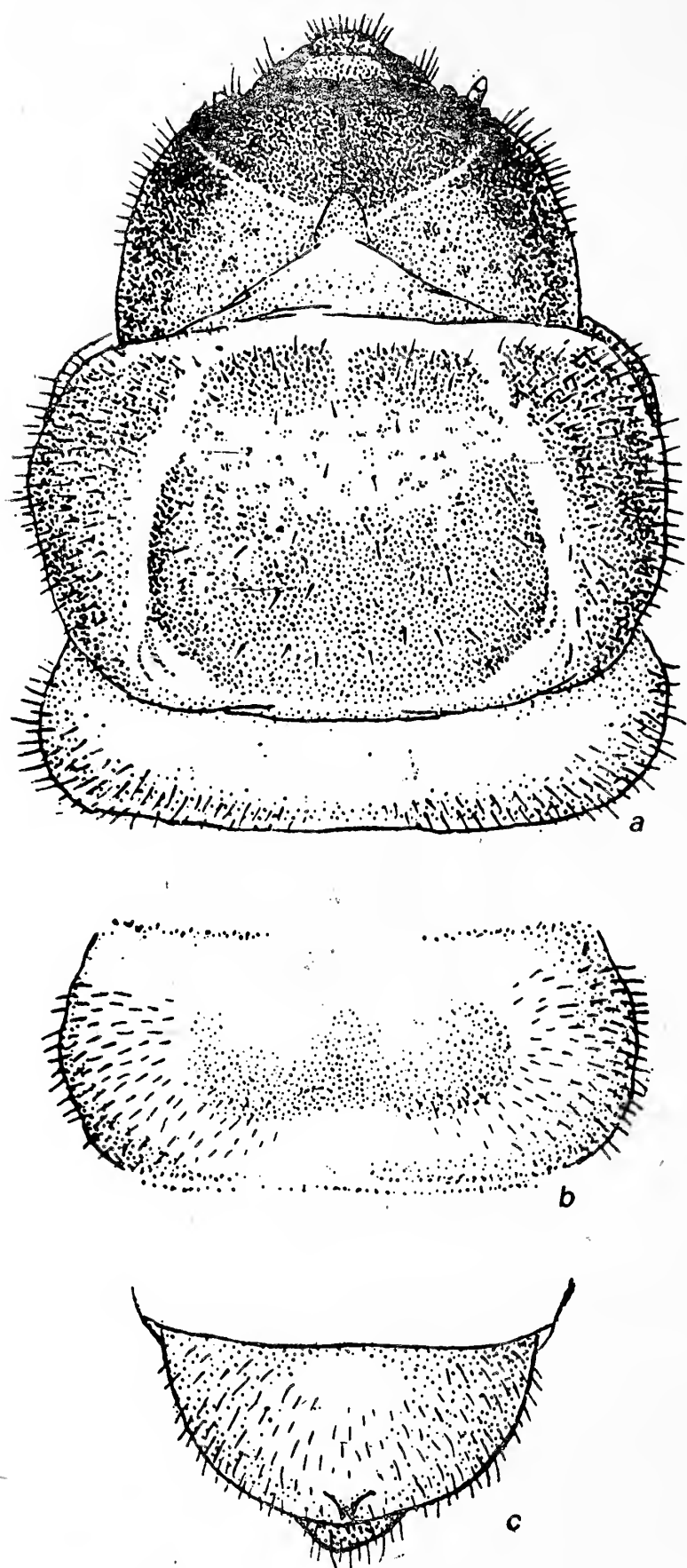


Figure 287. Larva of *Tetroplium castaneum* (L.).
a—head and pronotum; b—abdominal tergite
with locomotory ampulla; c—tip of abdomen.

forming group on anterior margin closer to antennae. Epistoma dark rust or brownish-red, darker on anterior margin, broadly impressed in middle, with long hairs forming transverse band in anterior half. Frontal sutures white, well developed, slightly concave. Median longitudinal suture continuous, dark brown. Hypostoma along anterior margin, and especially at base, markedly emarginate, slightly rounded laterally, with sharp gula medially, and thin hairs in anterior half; dark border along margins and around gula make hypostoma appear to consist of two distinct disjointed sclerites. Clypeus trapezoidal, white, rusty at base. Labrum rounded anteriorly, with short setae along margin, much longer ones at base along sides. Mandibles obliquely notched apically, with not very elongate lower and fully developed upper denticle; deeply notched on inner side at cultrate edge and here with two oblique carinae, one extending toward apex of lower denticle, the other parallel to first, trailing behind it.

Pronotum laterally with dense rusty hairs forming band bent down angularly along margins (dorsal view), stray hairs on disk in anterior half, brownish specks anterior to shield, broad transverse yellowish bands in anterior third, and glabrous, without hairs; anterior margin in this region with white border. Pronotal shield bulges, sclerotized, yellowish-rust, angularly emarginate or almost straightly truncate laterally on anterior margin, with deep longitudinal fold on sides, laterally sclerotized, with fine, barely perceptible hairs. Presternum brownish-red, with short rusty hairs, sclerotized border on inner margin at eusternum. Propresternum shagreen, glabrous, without hairs. Eusternum sclerotized, without perceptible white punctation, with stray setae.

Abdomen laterally with short rusty hairs. Locomotory ampullae developed on abdominal segments I to VII, bulge, entirely sclerotized and divided by common median longitudinal groove. Posterior end of abdominal tergite IX with pair of long proximate spinules set on common tubercular urogomphi. Length of mature larvae 18 to 22 mm, width of head 3.5 mm.

Pupa (Figure 288): Head short, flat on vertex between upper lobes of eyes, rounded or with two projecting contiguous tubercles on occiput set with one or two spinules. Antennae arcuate, flexed to sides, with acute spinules at apex of segments (especially 1st to 5th).

Pronotum transversely oval, bulges moderately, sometimes on anterior margin (especially in male) with small tubercular protuberance, fine transverse streaks in middle of disk; with distinct spinules, denser in anterior third and sparse elsewhere on surface, and fine light-colored setae laterally. Mesonotum (in region of scutellum) tubercularly elevated at apex, with highly numerous, sometimes large spinules. Metanotum bulges slightly or almost flat in anterior half, raised in middle of

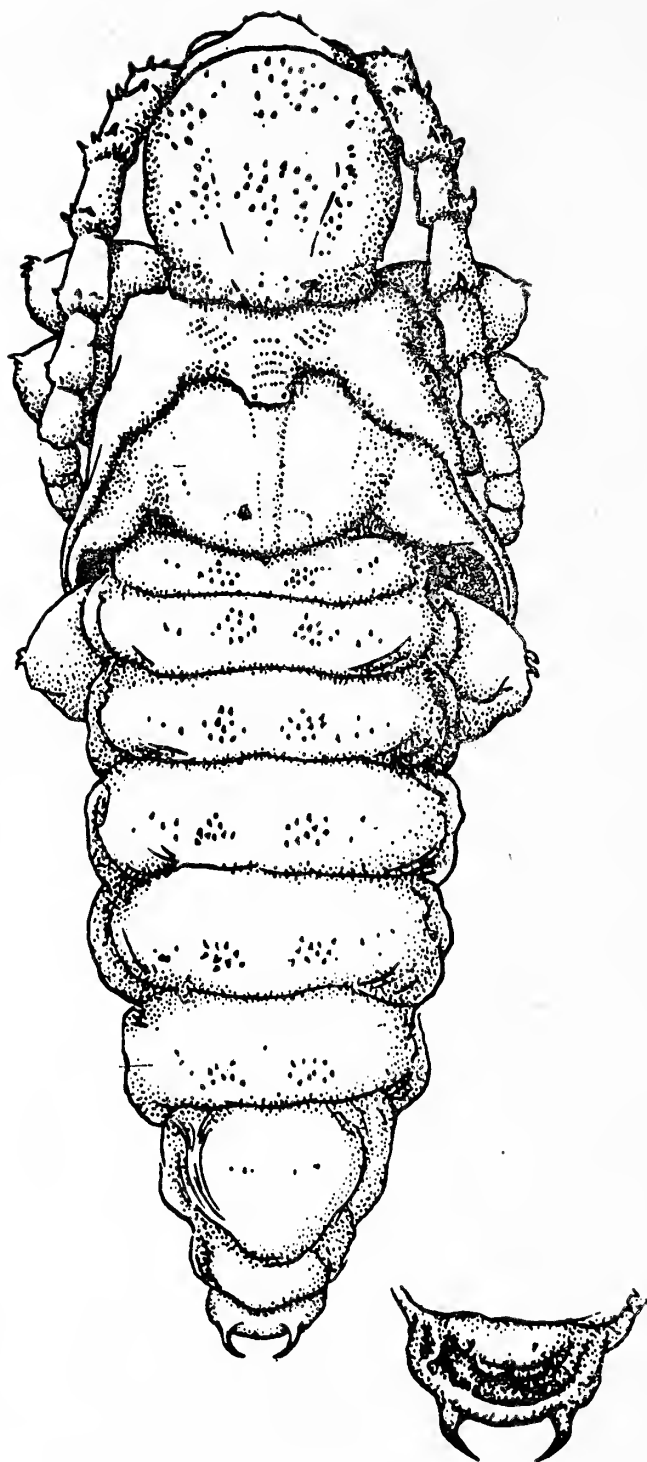


Figure 288. Pupa of *Tetropium castaneum* (L.), male.

446 posterior half, and here with fine spinules. Femora markedly dilated; hind femora with stray spinules at apex on outer side.

Abdomen elongate, insignificantly narrows anteriorly and gradually posteriorly. Abdominal tergites with common median longitudinal groove, transverse groove flexed posteriorly in anterior half, minute acute spinules anterior to transverse groove and on sides, very large spinules behind grooves forming two dense tufts in posterior half set on tubercular protuberances along sides of longitudinal groove. Tergite VII transverse, broadly rounded posteriorly, with stray minute spinules on disk sometimes forming transverse row. Tergite VIII glabrous, with-

out spinules. Abdominal sternites laterally with faint minute setae; sternites VI to VII in posterior half sometimes with stray large spinules. Tip of abdomen obtuse (ventral view), bound laterally by coriaceous glabrous carina, dorsally with long urogomphi that terminate in long acute spinule directed upward and bent under inward. Valvifers of female flat, tubercular, with distinct round process at apex on inner side. Length of body 12 to 19 mm, width of abdomen up to 4.0 mm.

Material: From eastern Ural region, Ob' region, Altai, Tuva, Trans-Baikal, Ussuri-Primor'e region, Sakhalin, and Kunashir. Adult insects 1,440, larvae 1,404, pupae 65.

Distribution: From Atlantic to Pacific Ocean coasts in coniferous zone: Europe, western and eastern Siberia, Tuva, Sakhalin, and Kunashir; northern Mongolia, northern China, Korea, and northern Japan.

Biology: Inhabits coniferous species, mainly fir-spruce and maple stands, and rises in mountains to forest zone. I found it in large numbers in Altai at about 2,000 m above sea level. Flight of beetles commences in May and continues up to September. Beetles maximum in June. During systematic surveys in different regions of Siberia, 724 insects were collected: three (0.4%) in May, 541 (74.7%)—June, 164 (22.7%)—July, 11 (1.5%)—August, and five (0.7%)—early September. High in mountains flight commences in last 10 days of June, ceasing end of July. For example, of the 121 insects collected in Altai (Kolyushta) 2,000 m above sea level, 32 were found in last 10 days of June and 89 in July, disappearing in early August.

Beetles creep onto decaying, recently dead standing and freshly felled trees. They are most active in warm weather. Female lays eggs in bark crevices, usually singly (at some distance from each other). Fecundity of beetles comparatively high. Ovaries of females dissected seven to ten days after emerging from wood contained 76 to 142 fully mature eggs. Larvae hatched from eggs two to three weeks after oviposition. In the laboratory 44 eggs were kept under observation at 15.2 to 20.8°C ($18.1 \pm 0.5^{\circ}\text{C}$); larvae hatched from them 10 to 19 days after oviposition, average 12.6 ± 0.3 days.

On hatching larvae immediately bore into bark, live underneath it, and damage drying bast. There they make longitudinal or transverse, straight or meandering, sometimes platformlike galleries slightly imprinted or not imprinted on alburnum, and plug them with fine frass. Mature larva bores into wood to a depth of up to 4.5 to 5.0 cm, makes cell there at right angle to trunk, plugs inlet with fibrous frass, and pupates in it with head toward inlet. Length of cell 38 to 40 mm, width 6.0 mm. Length of frass plug sealing pupal cell 10 mm, width of inlet 447 to wood surface 5.0 mm; inlet invariably extends along trunk.

Pupation of larvae commences early May and continues to end of

June. Pupae found in large numbers in early June. Development period of pupae in nature three to four weeks. Pupal transformation into adult occurs from last 10 days of May to first 10 days of July inclusive. Beetles formed break stopper sealing cell inlet, push frass aside, bore toward bark, nibble oval opening on bark surface, and abandon wood through it. Emergence of beetles from wood usually completed early July. Life cycle completed in two years. Data from weighings of 32 insects in different developmental stages: weight of larvae 32 to 269 mg (109.6 ± 10), pupae 26 to 245 mg (99.2 ± 9.1), and beetles 17.5 to 175.0 mg (76.6 ± 6.6).

This species mainly colonizes Siberian stone pine (*Pinus sibiricus*), fir (*Abies sibirica*), spruce (*Picea obovata*), rarely larch (*Larix sibirica*) and Scots pine (*Pinus sylvestris*). I raised 91 beetles from larvae collected in nature, of which 44 were from Siberian stone pine, 18—fir, 15—spruce, 10—larch, and four—Scots pine. *Rhagium inquisitor* (L.), *Acanthocinus carinulatus* Gebl., *Clytus arietoides* Reitt., and others quite often live together with this species on trunks of decaying trees.

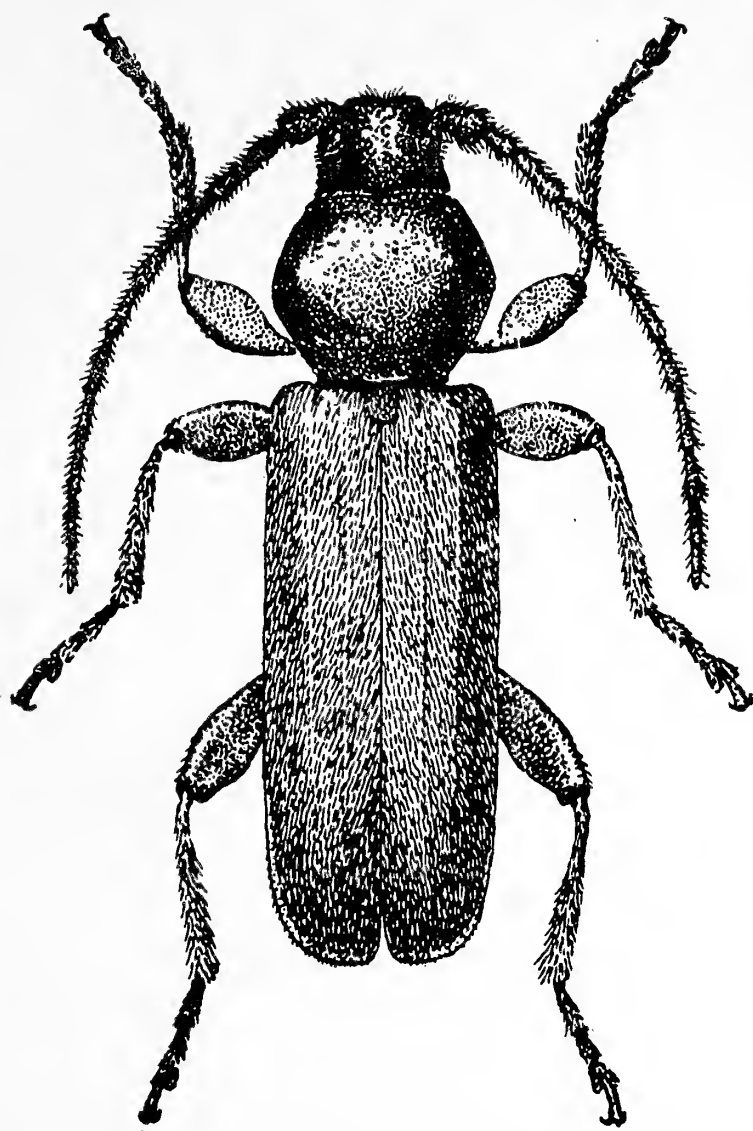
2. *Tetropium gracilicorne* Reitt.

Reitter, 1889, *Deutsch. Entom. Z.*, p. 287; Plavil'shchikov, 1940, *Fauna SSSR*, 22, 2, 34–35; Krivolutskaya, 1973, *Entomofauna Kuril'skikh ostrovov*, p. 104.

Adult (Figure 289): Close to *Tetropium castaneum* (L.). Differs in thin antennae, dense punctation on pronotal disk, absence of deep longitudinal suture between antennae, and other features. Head short, more rounded between antennae, with or without faint longitudinal suture, without tubercular protuberances on inner sides at antennal base, with moderately large close punctation and fine yellowish hairs. Antennae thin; 6th (male) or 8th (female) segment reaches beyond pronotal base. First antennal segment thick, 1.5 to 2.0 times longer than maximum thickness; rest of segments comparatively thin, thicken slightly at apex, not perceptibly nodose.

Pronotum not longer (female) or only slightly longer (male) than wide, rounded laterally, narrows more posteriorly, less so anteriorly, bulges on disk, with more or less perceptible median longitudinal groove, 448 with close deep punctation (spaces between punctures larger or not larger than punctures per se), and fine light-colored, easily abraded hairs. Scutellum with parallel sides or narrows slightly posteriorly, broadly rounded apically, with coarse or obliterated sparse punctation, and smooth median longitudinal band.

Elytra elongate, parallel, rounded apically, with slightly projecting longitudinal ridges on disk, very fine punctation imparting matte tone, and minute, barely visible hairs. Hind tarsi shorter than tibiae, with



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Figure 289. *Tetropium gracilicorne* Reitt.

1st segment not longer than subsequent ones. Body black, elytra light brown, antennae and legs reddish-rust (f. *typica*), sometimes body, elytra, antennae, and legs black (ab. *subaulicum* Plav.), or body, antennae, and legs black, elytra light brown (ab. *subluridum* Plav.), or body and elytra black, antennae and legs rusty or reddish (ab. *rubripes* Pic). Length of body 9.0 to 16.0 mm.

Egg: Elongate, broadly rounded at one pole, with distinct thin flat cellular sculpture, narrowly rounded at the other end, with less distinct, obliterated, very fine sculpture; usually smooth in middle. Length 1.4 mm, width 0.4 mm.

Larva (Figure 290): Close to larva of *Tetropium castaneum* (L.) in structure of head, but readily distinguished from it in specklike, not elongate spinules at tip of abdomen. Head narrowly rounded anteriorly, rusty, with large whitish spot laterally in anterior half and here with long thick setaceous hairs set on sclerotized flat specklike bases [in *Tetropium castaneum* (L.) base of hairs sclerotized, tubercular]. Epistoma dark rust, broadly darkened on anterior margin, notably impressed in

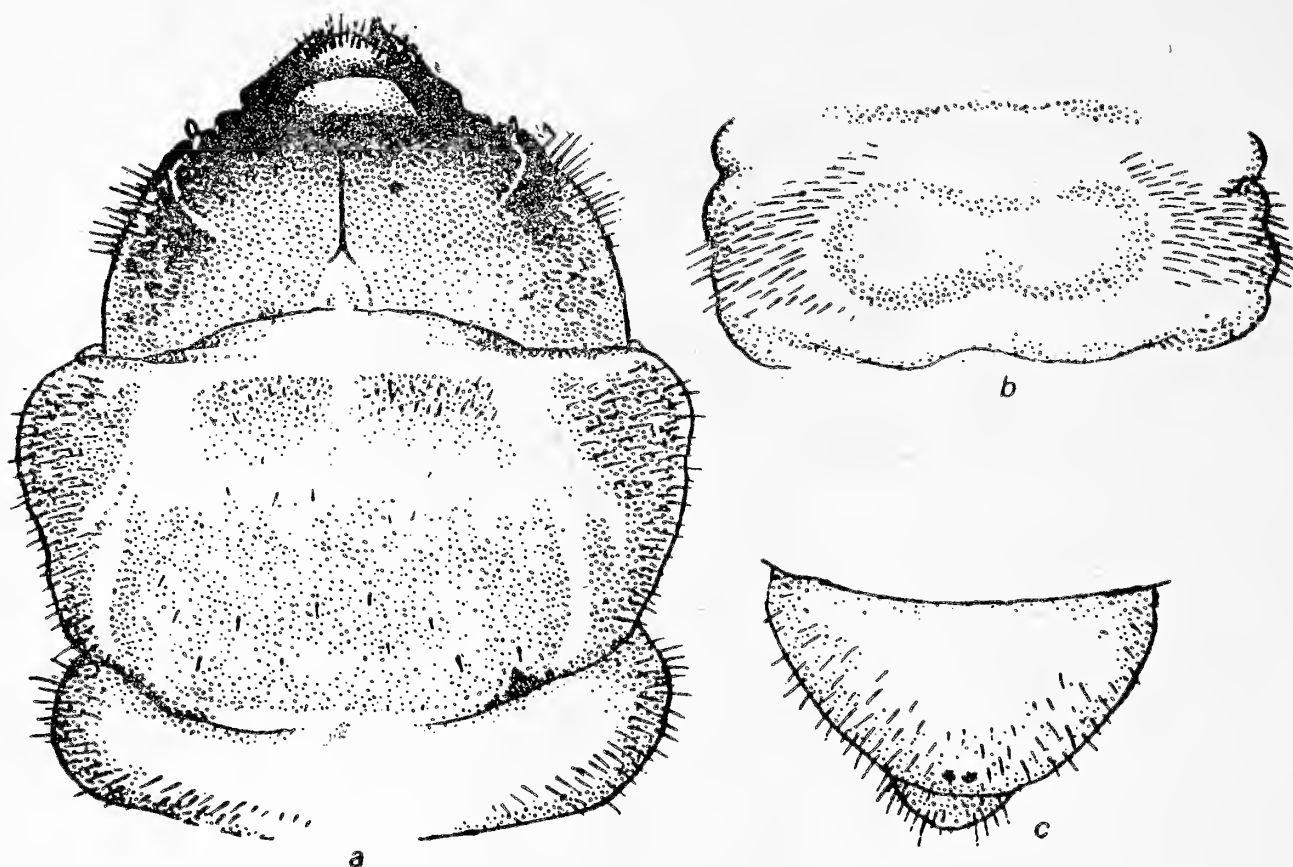


Figure 290. Larva of *Tetropium gracilicorne* Reitt.

a—head and pronotum; b—abdominal tergite with locomotory ampulla; c—tip of abdomen.

posterior half, slightly rounded laterally; frontal sutures white, sharp, slightly convex, longitudinal suture entirely dark brown. Hypostoma more than 2.0 times longer laterally than medially, divided longitudinally into two bordered sclerites bearing up to 10 or more small pubescent pores on inner half. Clypeus narrows markedly toward apex, white, with rusty base and apex; sometimes entirely dull yellowish-rust. Labrum transversely oval, broadly rounded, bulges on anterior margin, with
449 dense setae, white, at base glabrous and brown. Mandibles obliquely notched apically on inner side, with long carinae extending from upper margin toward apex of lower denticle and shortened second carina disposed obliquely and receding from lower denticle toward base.

Pronotum transverse, with moderately dense hairs laterally encircled at base by sclerotized rusty ringlet, and numerous short hairs on anterior margin. Pronotal shield sclerotized, with long lateral longitudinal fold, sclerotized on outer side, with stray white pubescent punctation. Presternum with dense short hairs encircled by rusty ringlet, and sclerotized on inner margin at base. Propresternum glabrous, without hairs, shagreen. Eusternum bulges, sclerotized, with stray faint hairs.

Abdomen laterally with moderately dense short tender hairs. Dorsal

locomotory ampullae on abdominal tergites I to VII bulge, entirely sclerotized, with common broad median longitudinal groove, and convex faint longitudinal fold laterally. Abdominal tergite IX glabrous on disk, with dense rusty elongate hairs laterally, and two proximate speck-like (hemispherical) spinules at apex set on common small tubercular coriaceous protuberance [in *Tetropium castaneum* (L.) these spinules are elongate, considerably longer than width at base]. Body length of mature larvae 15 to 19 mm, width of head 2.8 to 3.0 mm.

Pupa (Figure 291): Readily recognized by structure of mesonotum and absence of large spinules on it. Head usually bulges transversely

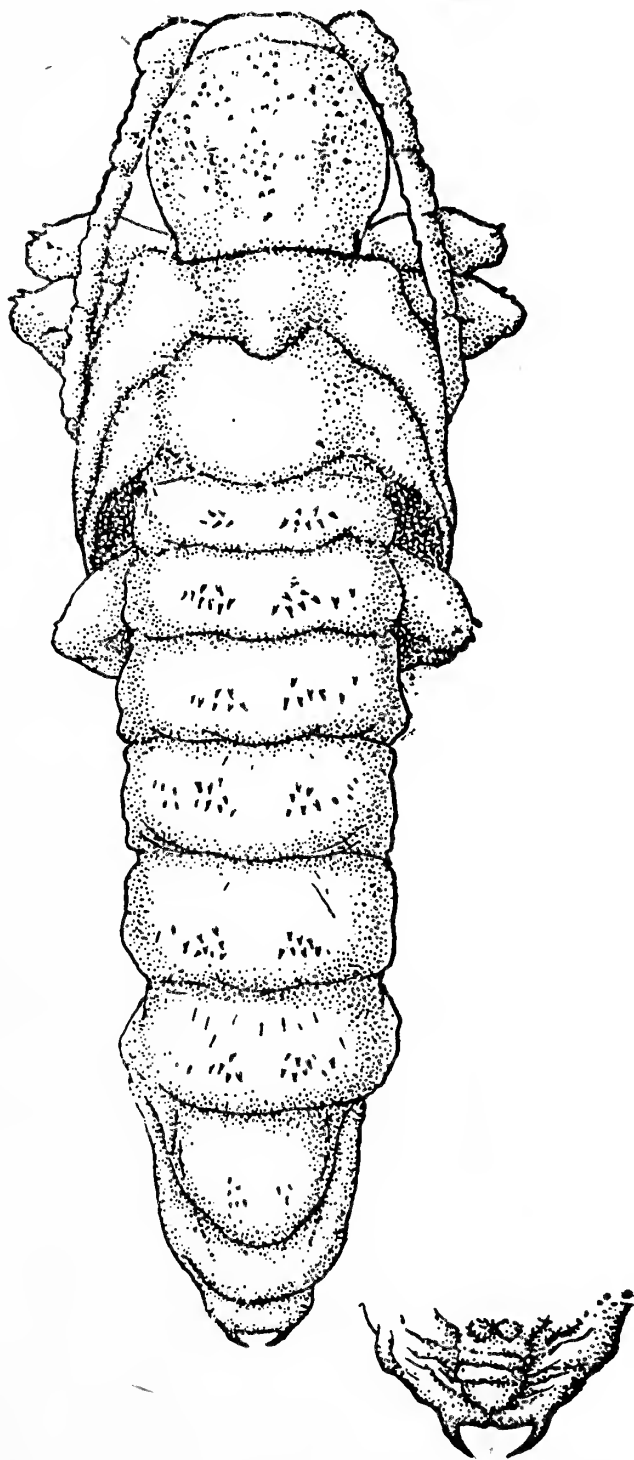


Figure 291. Pupa of *Tetropium gracilicorne* Reitt., male

between antennae, broadly impressed on vertex, rounded or with insignificant proximate tubercles on occiput and here with or without stray spinules. Antennae flexed to sides, arcuate, with one to two acute spinules on segments on outer side.

Pronotum broadly rounded in middle or in anterior half, usually narrows more posteriorly, less so anteriorly, bulges on disk, with grooved longitudinal folds in posterior half along sides diverging anteriorly, and faint transverse streaks between folds [in *Tetropium fuscum* (F.) longitudinal folds parallel, do not diverge]; with spinescent, unevenly distributed setae mainly in anterior half set on protuberant coriaceous base that is slightly sclerotized, and with or without setae in posterior half (especially along posterior margin). Mesonotum slightly raised apically,
 450 with very minute faint spinules visible only under high magnification [in *Tetropium castaneum* (L.) spinules larger, seen well even under low magnification]. Metanotum bulges slightly, and with or without very minute spinules. Femora apically with acicular or setaceous spinules on outer side forming transverse row.

Abdomen broadens in region of segments III to IV, gradually narrows posteriorly. Abdominal tergites along sides of longitudinal, comparatively broad, common groove in posterior half bulge tubercularly and here with acute setaceous spinules forming two tufts on each tergite. Sides of abdominal sternites with tender faint hairs; sternites VI to VII with pair of widely separated large spinules. Tip of abdomen (ventral view) bound laterally by horseshoe-shaped coriaceous glabrous carina, dorsally with pair of long urogomphi at end which terminate in subulate sclerotized spinule bent under and inward. Length of body 11 to 17 mm, width of abdomen 3.0 to 5.0 mm.

Material: From Ob' region, Altai, Tuva, Yakutia, Trans-Baikal, and Ussuri-Primor'e region. Adult insects 175, Larvae 411, pupae—38 males and females; 117 beetles were raised in the laboratory.

Distribution: From Ob' River basin, Altai to Pacific Ocean coast, including Siberia, Tuva, Sakhalin, and Kunashir; northern Mongolia, northern China, Korea, and northern Japan (Hokkaido and Honshu).

Biology: Lives in deciduous vegetation and mainly found in forests of foothills and mountains. Flight of beetles observed in June and July, maximum in middle 10 days of July, with stray specimens up to early September. Beetles lead a cryptic mode of life, not seen on flowers; they creep only onto trunks of recently dead trees, those damaged by fire and Siberian silkworm (*Dendrolimus sibiricus* Tschetv.) or wind-felled, and so forth. Female lays eggs in bark crevices. From eggs laid in a forest on June 27 to July 2 (19 eggs under observation), larvae hatched on July 17. Mean daily atmospheric temperature during this period was $19.7 \pm 0.2^{\circ}\text{C}$.

On hatching larvae tunnel into bark, live underneath it, make galleries in decaying bast, and plug them usually with fine fibrous frass. Galleries longitudinal, rarely transverse, straight or meandering, slightly impressed or, more often, not impressed on sapwood, and quite often extend into cork layer. Width of gallery 10 mm. Mature larva makes cell in bark along trunk, lines it with frass, nibbles an exit to bark surface, and pupates in cell with head toward exit. Length of cell 16 to 22 mm, width 7.0 mm.

Pupation of larvae commences end of May or early June and ends in early July. In Tuva in 1976 a large number of pupae were found in middle 10 days of June. Pupae develop in about three weeks. For example, from pupae appearing on June 11, beetles began emerging on July 2nd, and from pupae formed on June 18, beetles emerged on July 11. Atmospheric temperature during this period was 11.7 to 32.0°C ($19.5 \pm 0.7^\circ\text{C}$). Developed beetles nibble oval openings on bark surface and escape. They are found in pupal cells in June and July, and their emergence ceases mid-July. Weight indexes of 31 insects revealed: weight of larvae before pupation 38 to 138 mg (average 69.0 ± 4.1), pupae 34 to 108 mg (61.2 ± 3.5), and beetles before emerging from pupal cells 23 to 87 mg (49.2 ± 3.1).

451 *Acanthocinus carinulatus* Gebl., *Callidium chlorisans* (Sols.), and *Rhagium inquisitor* (L.) colonize together with this species under bark of the same trees. I found this species only on larch in 1939 to 1941, in large numbers in deciduous forests of Trans-Baikal damaged by Altai larch woodborer [*Xylotrechus altaicus* (Gebl.)]. There *Tetropium gracilicorne* Reitt. is the first to attack, followed by the aforementioned pest.

3. *Tetropium fuscum* (F.)

Fabricius, 1787, *Mant. Ins.*, vol. 1, p. 154 (*Callidium*); Plavil'shchikov, 1940, *Fauna SSSR*, 22, 2, 39-40.

Adult (Figure 292): Differs from adult of preceding species in broad whitish pubescent transverse band at base of elytra, and much lighter color (straw-yellow) of latter. Head between antennae with short deep longitudinal suture, dense punctation, and long light-colored hairs. Apices of antennae reach beyond middle of elytra (male) or do not reach this level (female), and covered with long dense hairs. Second to 5th antennal segments apically thickened, nodose; others slightly produced anteriorly, appear serrate; 11th segment short and oval, pointed apically (female) or long, considerably longer than 10th, with distinct constriction behind middle, and usually not pointed but rounded at apex (male).

Pronotum broadens anterior to middle, narrows more toward base, not longer than wide (female) or slightly longer (male), bulges notably with more or less distinct longitudinal impression medially, narrow

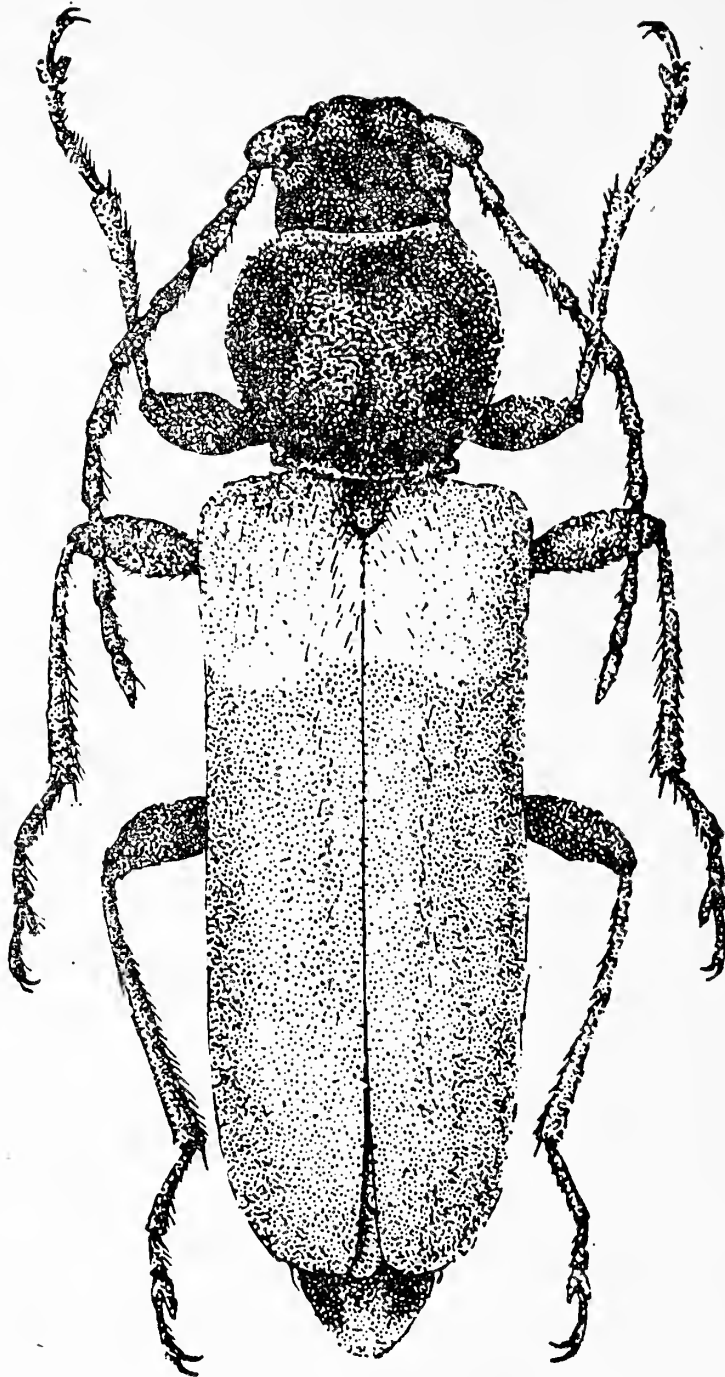


Figure 292. *Tetropium fuscum* (F.).

flange at base, and bent posterior margin; striate, with dense, sometimes deep, fused punctation [only in some specimens is punctation on pronotal disk smoothened, dispersed, as in *Tetropium castaneum* (L.)], with easily abraded yellowish hairs. Scutellum narrows slightly toward apex or with parallel sides, broadly rounded apically, with coarse dense or sparse punctation.

Elytra elongate, parallel, with two longitudinal ridges on disk extending from base almost up to hind clivus, broadly rounded at apex, with very small close punctation, short black or dark brown hairs, and invariably light-colored close hairs basally. Hind tarsi distinctly shorter than tibiae, with 1st segment equal to two successive ones together. Body black, elytra straw-yellow, with broad velvety light-colored trans-

452 verse band at base, and antennae rusty or rusty-brown. Pronotum with rusty border at base and apex, legs brownish-yellow, femora usually very darkened (f. *typica*); sometimes pronotum entirely black, without rusty border (ab. *obscuratum* Pic), or head dark yellowish-rust and pronotum black on disk (ab. *ferruginipes* Pic). Sometimes head, pronotum, and underside of thorax black, abdomen rusty-red. Length of body 9.0 to 13.0 mm.

Larva: Very similar to larva of *Tetropium castaneum* (L.). Differs in sparse hairs on sides of head and structure of spinules on posterior margin of abdominal tergite IX. Head rusty or reddish-rust, with narrow white band laterally and here sparse long setaceous hairs in anterior half with flat sclerotized base [in *Tetropium castaneum* (L.) hairs on sides very numerous, with sclerotized tubercular base]. Anterior margin of epistoma along sides of longitudinal suture with deep alveolar dent, broadly impressed medially. Posterior margin of abdominal tergite IX with pair of small sclerotized spinules intercepted by space not less than diameter of spinule per se [in *Tetropium castaneum* (L.) interception absent or less than diameter of spinule]; spinules set on tubercular base with extensive indistinct sclerotization (without sclerotization in *Tetropium gracilicorne* Reitt.). In other features larva of this species similar to larva of preceding species. Body length 18 mm, width of head 0.8 mm.

Pupa: Differs from pupa of *Tetropium castaneum* (L.) in slightly raised (bulging) apex of mesonotum devoid of large spinules. Pronotum bulges, rounded laterally, narrows more anteriorly, with short longitudinal grooved fold along sides of disk, and minute uneven spinules. Apex of mesonotum (in region of scutellum) slightly raised and spinules here minute, barely visible under high magnification (in this regard similar to pupa of *Tetropium gracilicorne* Reitt.). Abdominal tergites bulge in posterior half, with acute spinules along sides of common longitudinal groove forming transversely elongate band that narrows laterally. Tergite VII behind middle with minute spinules forming indistinct transverse row. In other features pupa of this species similar to pupa of other species of the genus *Tetropium*. Length of body 17 mm, width of abdomen 3.8 mm.

Material: From the Urals. Adult insects two, larvae three, pupa—one female.

Distribution: Inhabits Europe, rarely found in western Siberia. I did not find it there. Known in temperate zones of the Urals. Ecologically associated with spruce and pine (Plavil'shchikov, 1940).

4. *Tetropium aquilonium* Plav.

Plavil'shchikov, 1940, *Fauna SSSR*, 22, 2, 37–38.

Adult (Figure 293): Differs from all other species of the genus *Tetropium* in densely pubescent head, pronotum, and elytra. Head between antennae with short longitudinal suture, flat on vertex between upper lobes of eyes, rounded on occiput, with close punctation, and long dense yellow hairs in form of two vortexes on occiput. Eyes completely separated into lower and upper lobes; septum between them smooth, without facets. Antennae comparatively short, barely reach beyond middle of elytra (male) or considerably short of this level (female). First antennal segment short, rounded at apex; 2nd to 5th segments thicken apically, nodose; 2nd one short, others almost equal in length.

Pronotum bulges, broadly rounded in middle, narrows more posteriorly, less so anteriorly, not longer than wide (male) or even shorter (female); with narrow transverse groove at anterior and posterior margins, margins slightly curved, with median longitudinal, sometimes faint groove on disk, small alveolar lateral impression anterior to middle,

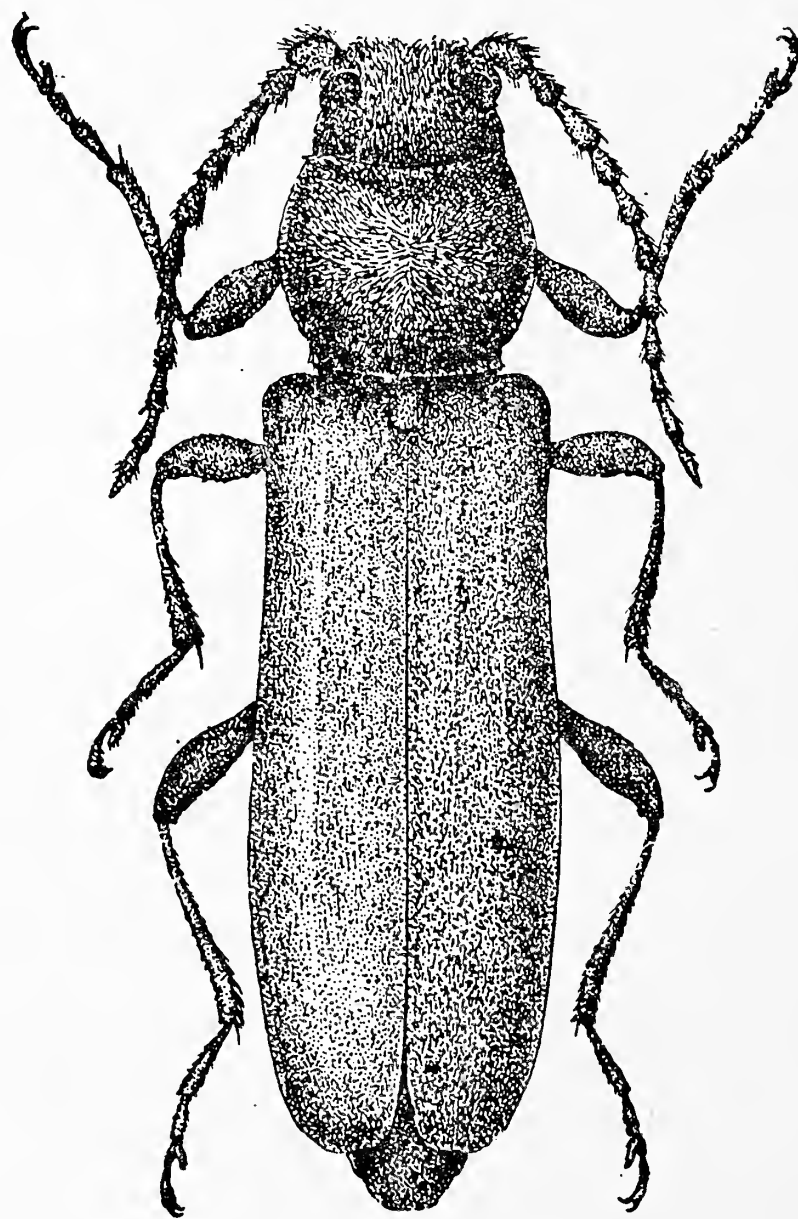


Figure 293. *Tetropium aquilonium* Plav.

very small close punctation, and dense light-colored adherent hairs in form of two vortexes on disk. Scutellum with parallel sides, broadly rounded posteriorly, with fine punctation.

Elytra elongate, bulge, with parallel sides, broadly rounded apically and slightly flattened there, with two more or less distinct longitudinal ridges on disk, close very fine punctation imparting matte oily tone, and dense, short, light-colored, adherent hairs forming almost compact cover. Head black, with rusty frontal tubercles at antennal bases; pronotum blackish-brown, with reddish-rust border on anterior and posterior margins; scutellum rusty-brown or chestnut; elytra dark brown with rusty tinge at base or reddish-brown. Body ventrally reddish-rust or brownish-chestnut. Length of body 9.5 to 13.0 mm.

Material: From Pechora River and Lower Ob' region (collection of Moscow State University and the Zoological Institute); known from northern region of Kola Peninsula up to northern Ob' region. Flight of beetles in July.

Biology: Not studied.

11. Tribe ATIMINI

Adult insects differ from beetles of other tribes in highly pubescent body, broad flat prosternal process, and widely separated hemispherical forecoxae.

Larvae characterized by presence of pigmented ocellus on parietals at base of antennae, markedly bulging locomotory ampullae on abdominal segments IV to VI, and long spinules bent under and somewhat forward on posterior margin of tergite IX.

Pupae distinguished from pupae of other tribes of Aseminae by presence of piliform setae on abdominal tergites, urogomphi turned upward and slightly forward, not bent down and inward.

454 This tribe includes two genera. Species of the genus *Atimia* inhabit eastern Asia and those of both *Atimia* and *Paratimia*, North America.

1. Genus *Atimia* Hald.

Haldeman, 1847, *Trans. Amer. Philos. Soc.*, 10, 2, 56; *Myctus*, Semenov-Tian-Shanskij and Plavilstshikov [Semenov-Tian-Shanski and Plavil'shchikov], 1937, *Bull. Soc. Entom. France*, 42, 17, 252; Gressitt, 1951, *Longicorn Beetles of China*, vol. 2, pp. 42-43; Linsley, 1962, *Cerambycidae of North America*, 11, 19, 92-93; Kojima and Hayashi, 1969, *Insect Life in Japan*, p. 169; Cherepanov and Cherepanova, 1973, *Nov. i maloizv. vidy fauny Sibiri*, vol. 7, p. 79.

Adult: Characterized by moderately elongate, comparatively dilated

pubescent body. Head short and broad, eyes highly emarginate, divided into two lobes (upper and lower), joined by septum. Pronotum transverse, with almost parallel sides, bulges, with dense punctation. Elytra parallel, truncate or slightly notched apically, bulge on disk, with close punctation, dense adherent hairs, and smooth glabrous platformlike spots.

Larva: Head broad, with dense long hairs laterally in anterior half, and distinct pigmented ocellus at base of antennae. Pronotal shield sclerotized. Propresternum glabrous. Presternum with sparse hairs. Locomotory ampullae on abdominal segments IV to VI bulge markedly, those on segments I to III and VII slightly. Posterior margin of tergite IX with pair of widely separated sharp spinules bent under and slightly forward; spinules set on urogomphi.

Pupa: Head short and broad. Posterior half of abdominal tergites with long piliform setae forming transverse row. Pair of widely separated urogomphi at tip of abdomen terminate in long acute spinule turned upward and slightly forward, not bent down and inward.

Species of the genus *Atimia* inhabit Asia and North America. One species each found in Mongolia and Ussuri-Primor'e region, three species in Japan, one in southeast China, and five in North America.

Type species: *Atimia tristis* Haldeman, 1847.

KEY TO SPECIES

Adult Insects

- 1 (2). Elytra with produced inner angle at apex, and in posterior half of disk without smooth longitudinal ridge. 1. *A. nadezhdae* Tsher.
- 2 (1). Elytra with rounded, not produced inner angle at apex, and in posterior half of disk with smooth longitudinal ridge. 2. *A. maculipuncta* (Sem. and Plav.).

1. *Atimia nadezhdae* Tsher.

Cherepanov and Cherepanova, 1973, *Nov. i maloizv. vidy fauny Sibiri*, vol. 7, pp. 80–85.

Adult (Figure 294): Body slightly elongate. Head broad, directed ventrally and slightly anteriorly, retracted almost up to eyes into prothorax, and with close adherent hairs. Frons broad, even, flat, or insignificantly concave; with rather small punctation and erect fine hairs. Vertex bulges slightly, with very coarse punctation, and smooth lustrous median longitudinal band. Genae very short. Eyes advanced almost to
455 base of mandible, bulge, with sharp and coarse facets, and emarginate

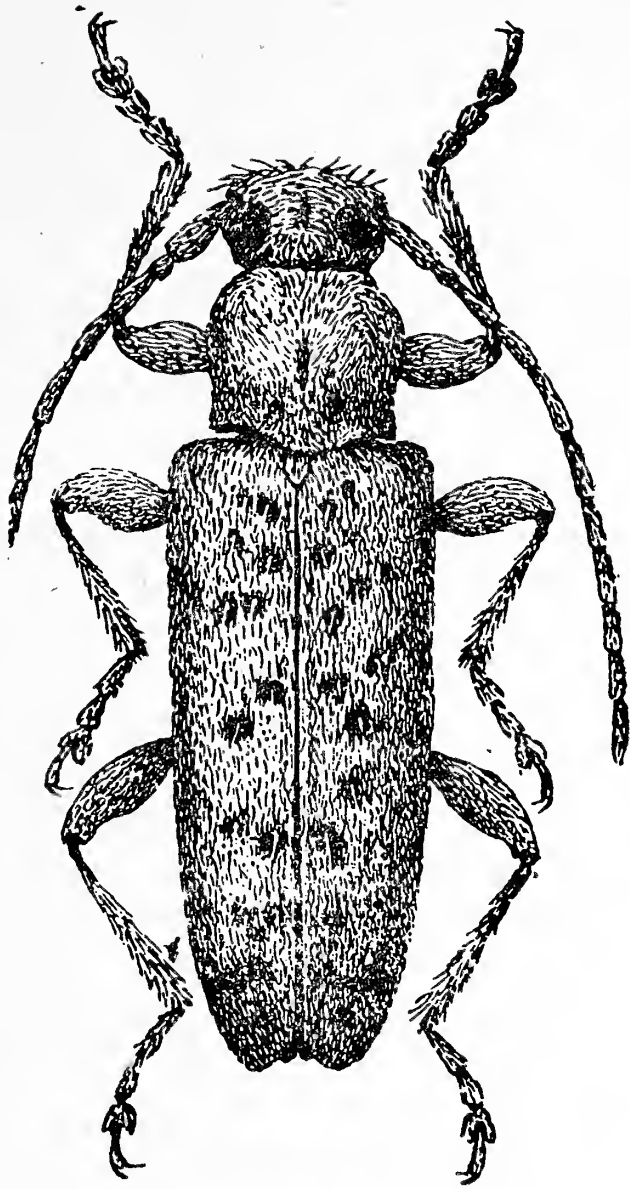


Figure 294. *Atimia nadezhdae* Tsher.

on inner side to such an extent that narrow septum not more than 1.0 mm remains between upper (smaller) and lower (much larger) lobes. Antennal sockets small, widely separated, located in notches of eyes. Antennal apices in female reach beyond 0.50, in male just beyond 0.66 length of elytra. First segment of antennae thick, markedly thickens from base to apex; 2nd segment short, slightly longer than wide; 3rd to 11th segments elongate, slightly compressed laterally; 5th equal to 2nd and 3rd together; 6th to 10th segments not longer or even shorter than 3rd. Eleventh segment broadens gradually from base to apex, narrowly rounded in apical third; 2nd to 11th segments with dense closely adherent hairs and sparse fine hairs.

Pronotum not longer or even shorter than width, broadens notably from base toward apex, narrows insignificantly in anterior third, massive, slightly compressed at anterior angles, distinctly so at base, tubercularly raised on disk along sides of midline; with even, comparatively close punctation, smooth median longitudinal band in posterior half,

long adherent hairs directed into anterior half from anterior angles posteromedially, and in posterior half from posterior angles anteromedially, and long sparse semierect fine hairs. Hind process of prothorax flat, broad, slightly bent under toward body, and broadens apically. Process of mesothorax even, flat, emarginate posteriorly, with projecting posterior angles. Legs short; forefemora thick, cylindrical, hind ones much thinner, notably elongate, with apices reaching beyond 0.66 length of elytra. Foretibiae with close adherent fine hairs and sparse long semierect setae; inner side of mid- and hind tibiae with dense adherent hairs, outer side with larger semierect hairs. Hind tarsi not longer or even shorter than tibiae, with 1st segment longer than 2nd, but shorter than 2nd and 3rd together. Scutellum small, with parallel sides or narrows slightly from base toward apex, broadly rounded on posterior margin, with dense gray adherent hairs.

Elytra bulge somewhat, with parallel sides, narrow slightly in posterior fourth, notched apically, with rounded outer and projecting inner angle, with dense even punctation, and dense adherent gray hairs; with smooth, glabrous, lustrous, roundish (partly fused) facets, each usually bearing one elevated seta; five to seven facets on each elytra near suture, and five to six outer forming two indistinct longitudinal rows.

Abdomen narrows from base to apex, with close adherent hairs. Abdominal sternites bulge, sternite I slightly shorter than II and III
 456 together, sternites I to II in female with perceptible lateral dents, sternite V in male broadly emarginate at posterior margin, rounded in female. Body black, with dense adherent gray hairs and sparse erect setae, with glabrous longitudinal black band on vertex, very long band in posterior half of pronotum, and glabrous, smooth, lustrous black facets on elytra. Body length of male and female 5.0 to 7.0 mm.

Larva (Figure 295): Differs from larvae of other species in locomotory ampullae on abdominal segments IV to VI with papilliform protrusion, and in structure of head. Body moderately elongate, gradually narrows from thorax toward tip of abdomen. Head markedly retracted into prothorax, almost 2.0 times wider than long, narrowly rounded anteriorly, flat dorsally, with dense deep punctation (pores) laterally in anterior half and long rusty setaceous hairs, and pigmented ocellus at base of antennae. Epistoma broad, slightly impressed, biapical posteriorly, bound laterally by sharp whitish frontal sutures, divided by well-developed median longitudinal suture, with sparse minute setaceous pores. Hypostoma broadens slightly toward base, divided medially. Clypeus small, trapezoidal. Labrum transversely oval, with long setae in anterior half. Mandibles elongate, obliquely notched apically, with projecting upper and lower denticles, and carinate elevation on inner side. Prothorax broad, length 0.40 width, and narrows anteriorly from base.

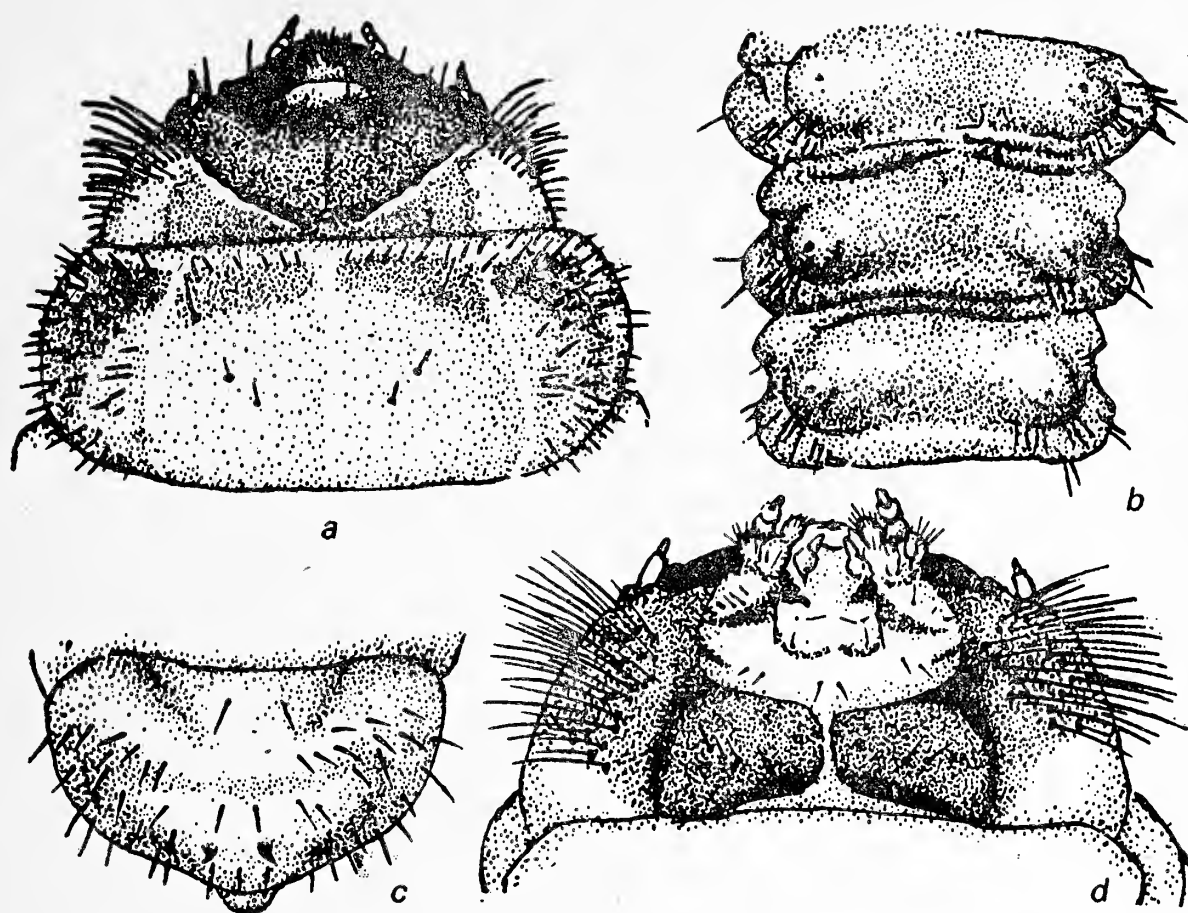


Figure 295. Larva of *Atimia nadezhdae* Tsher.

a—head and pronotum; b—abdominal tergites with locomotory ampullae; c—tip of abdomen; d—head (ventral view).

Pronotum slopes moderately toward head, with large punctation on anterior margin, and small (in middle) and large (on sides) hairs. Pronotal shield bound by lateral longitudinal folds, flat, matte, with minute spinules and large longitudinal alveolar punctation; with three pairs of widely spaced setae, of which one very large on anterior margin, second very small in middle, and third pair of minute setae shifted to posterior half of shield and proximate to midline. Presternum finely speckled, with sparse hairs. Propresternum glabrous. Eusternum sclerotized at base, with minute spinules forming transverse band. Thoracic legs well developed, segmented, with acute acicular claw.

Locomotory ampullae on abdominal segments I to III bulge slightly, divided by median longitudinal groove; on segments IV to VI with papilliform lateral protrusion, divided by broad median groove; and bulge insignificantly on abdominal segment VII. Abdominal tergite IX with two acute, widely separated large spinules, with space between them covering 0.20 width of tergite. Body white, mandibles and anterior margin of head dark brown, and epistoma and sclerites of hypostoma rusty. Anterior margin of pronotum with well-developed rusty transverse band, divided by three longitudinal white lines into four trans-

verse rectangular rusty spots. Length of larvae before pupation 8.0 to 12.0 mm, width of head 1.8 to 2.0 mm.

Pupa (Figure 296): Characterized by presence of setae on dorsal side of body, long parallel urogomphi at tip of abdomen, and well-developed tubercle on sides of head at bases of antennae. Body moderately elongate. Head short and broad, flat between antennae; with long sparse setae on sides behind antennae (six setae on each side), four setae between antennae, three large setae at antennal base, and six setae in transverse row at base of clypeus. Antennae flexed to sides, semi-circular, with minute spinules on outer side.

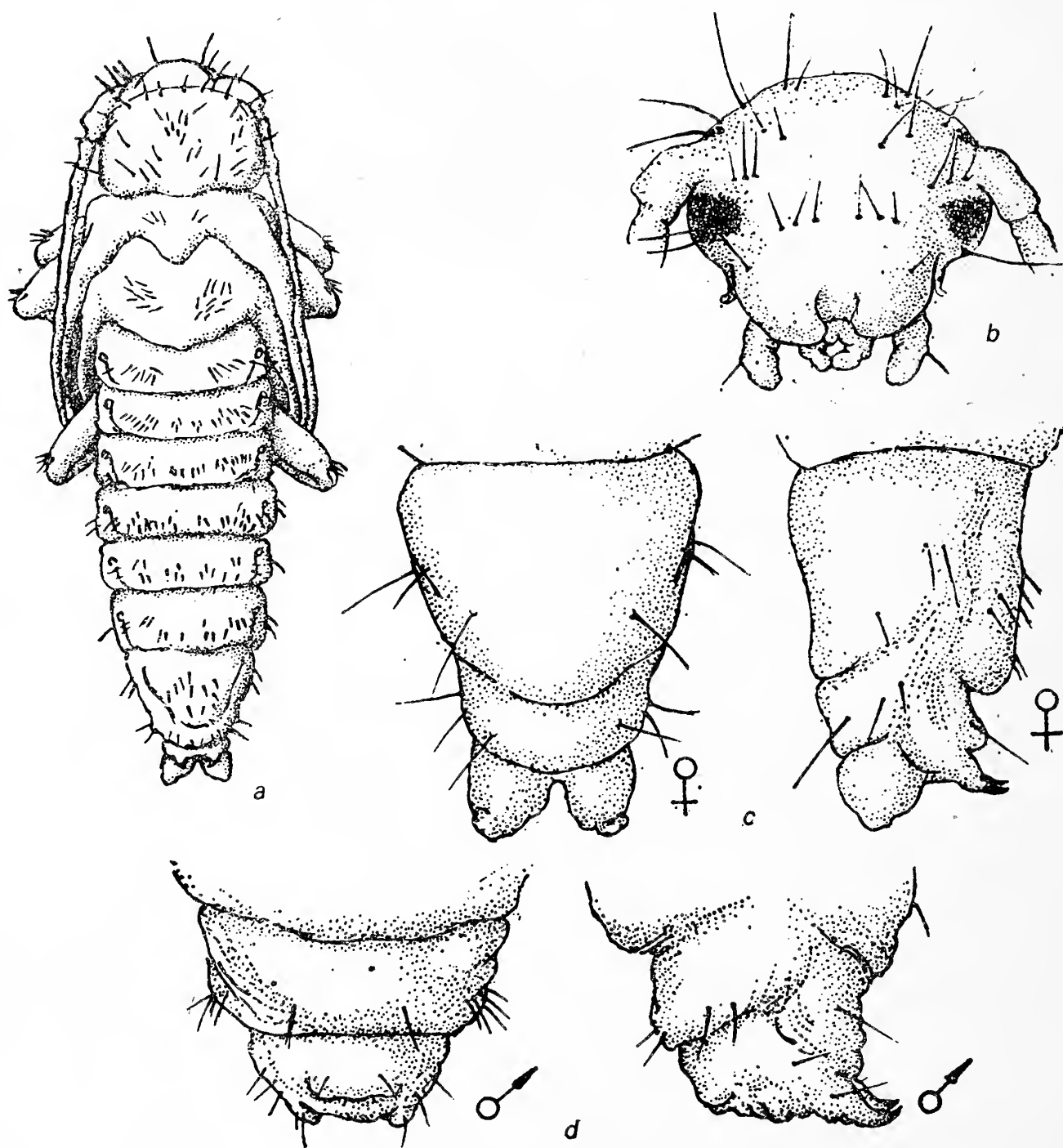


Figure 296. Pupa of *Atimia nadezhdae* Tsher.

a—dorsal view; b—head; c—tip of abdomen (ventral and lateral view), female; d—same, male.

Pronotum bulges, almost square, medially with longitudinal transversely striate narrow band set with group of minute setae; anterior margin and base with sparse long setae forming two transverse bands. Mesonotum angularly narrows posteriorly, with long thin setae forming one tuft laterally. Metanotum flat or bulges slightly, broadly rounded posteriorly, with six to eight setae in posterior half along sides forming distinct tuft.

Abdomen narrows gradually toward apex. Posterior half of abdominal tergites with short setae forming transverse row; in female setae dispersed in posterior half on abdominal tergite VII. Urogomphi at tip of abdomen extend upward, parallel, and terminate in brownish-rust acute spinule bent somewhat forward. Valvifers of female large, with papilliform protrusion apically which projects far backward and is visible in dorsal view. Length of body 7.0 to 9.0 mm.

Material: From Ussuri-Primor'e region, Artemovka River, and Zmeinaya hills. Adult insects 43, larvae 21, pupae—five males and three females, and larval exuviae with beetles from pupal cells 23. This species is named after Nadezhda Epifanovna Cherepanova, who studied its biology.

Biology: Beetles sighted end of July and in August. They hibernate in winter, mate in spring, and lay eggs on trunks and branches of needle juniper (*Juniperus rigida*). Larvae live under bark, make longitudinal galleries deeply impressed on wood, and plug them behind with fine frass. Width of gallery before pupal cell 5.0 mm, length of gallery 12 to 15 mm. Before pupation larva nibbles pupal cell in upper wood layer under or in bark, more often along trunk, rarely transversely. Length of cell 10 mm, width 5.0 mm.

Pupation of larvae occurs in July and early August. At time of pupation larvae weigh 9.0 to 27.0 mg. During metamorphosis their weight decreases significantly, with reduction greater in male than in female. Two male larvae together weighed 25.1 mg (100%), their pupae 21.9 mg (87.2%), and adults before emerging from wood 17.3 mg (68.8%). Corresponding figures for four females: 73.5 mg (100%), 66.2 mg (90%), and 57.6 mg (78.3%). Weight loss in pupal stage depends partly on wood moisture. Thus a pupa enclosed in dry wood weighed 15.5 mg on July 22 and 12.8 mg on August 7th, i.e., during this period weight dropped by almost 17.5% or 5.3% above normal. Developed beetles nibble oval openings (3.0 mm × 1.8 mm) on bark surface and emerge through them. Durings this period they lose up to 20% weight. Young beetles remain in hibernation and begin to reproduce only in spring of the following year. They colonize trunks and branches of juniper ranging from 1.0 to 25.0 cm in diameter. Population density comparatively high. From a wood cutting 6.0 cm in diameter and 67 cm long, 14

beetles emerged; from another cutting 5.0 cm in diameter and 44 cm long, 16 beetles emerged; and from a third cutting 3.0 cm in diameter and 37 cm long, three beetles emerged. These cuttings additionally contained 29 larvae killed by parasites.

459 2. *Atimia maculipuncta* (Sem. and Plav.)

Semenov-Tian-Shanskij and Plavilstshikov [Semenov-Tian-Shanski and Plavil'shchikov], 1937, *Bull. Soc. Entom. France*, 42, 17, 253 (*Myctus*).

Adult: Differs from adult of preceding species in rounded angles of elytral apices, smooth longitudinal ridge on elytra in posterior half, and broader, more flattened pronotum. Head short, narrow than pronotum, with close punctures (distance between them smaller than punctures per se), and dense sessile hairs. Antennae in female extend slightly beyond middle of elytra; 2nd segment 0.50 length of 3rd; 4th notably shorter than 5th but longer than 3rd; each successive segment almost equal in length to 3rd. Pronotum bulges slightly (more flattened on disk than in *Atimia nadezhdae* Tsher.), not longer than wide, broadens markedly in anterior half, narrows gradually toward base; with small close punctation, and smooth median longitudinal band. Scutellum small, with parallel sides, broadly rounded posteriorly, with dense hairs. Elytra parallel, bulge moderately, with dense adherent hairs, obtuse apically, and rounded at angles; with uneven punctation, smooth glabrous black spots on disk, especially in posterior half, and smooth longitudinal ridge with smooth black spots alongside it. Length of body 7.0 to 8.0 mm.

Material: From Mongolia and Alanginsk mountain range (collections of Zoological Institute and Moscow State University). Adult insects three.

Distribution: Mongolia.

Biology: Not definitely known. Probably similar to that of preceding species. Flight of beetles in June.

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